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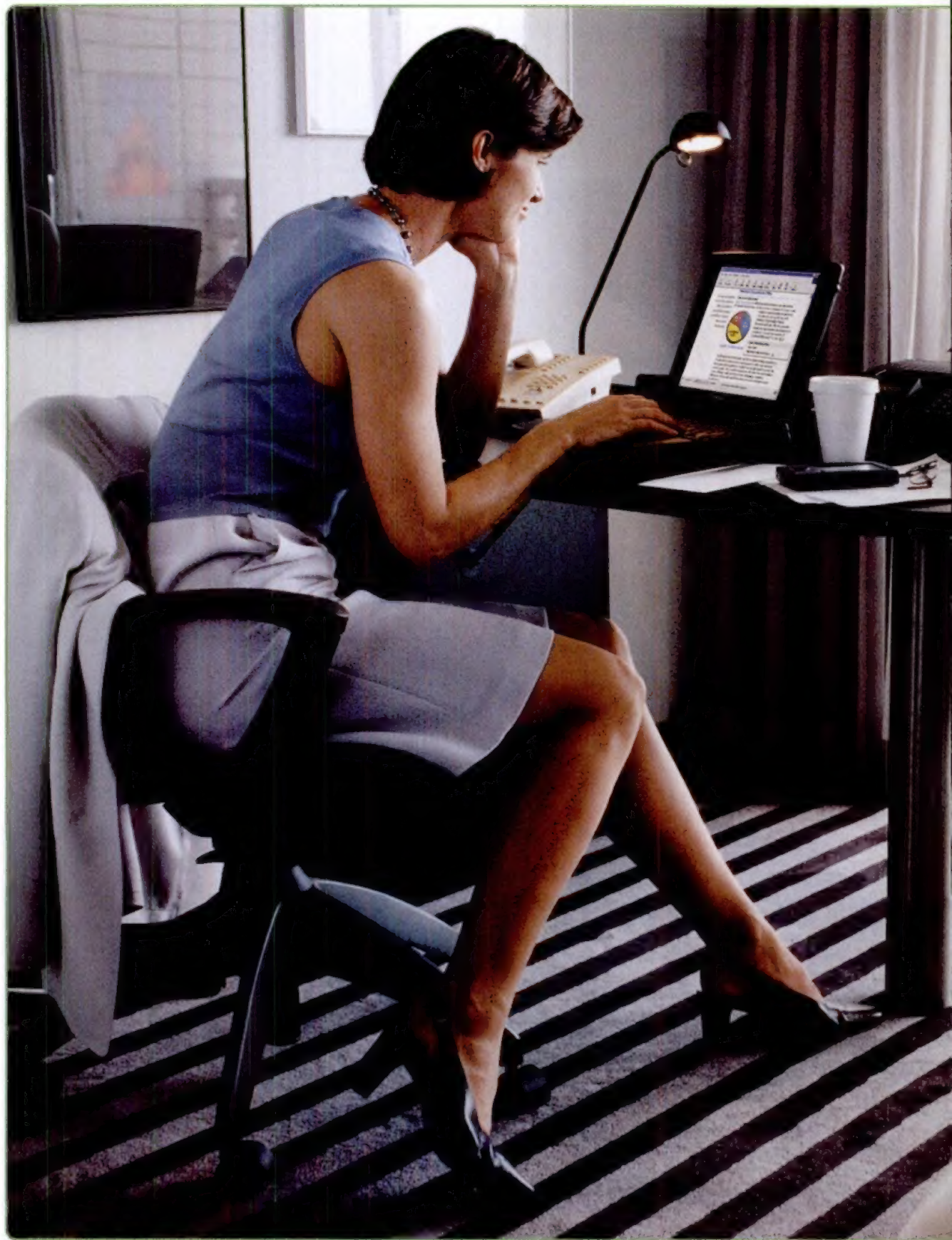
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You've Got Mail (and Apps)!

If you're like me, you most likely have multiple e-mail accounts. I have a corporate mail account, another home account that comes from my Internet service provider, and a couple of accounts on Web sites that offer free e-mail, such as MSN Hotmail. All of these accounts let me send and receive messages,

receive attachments, and manage address books, but they are all very different kinds of applications.

My corporate mail account, where I get the bulk of my mail, is the *traditional client/server application* to which we've all become accustomed. It's managed by people within the company, hosted on servers within the building where I work, and based on software we license from a major company. Thus, our company has total control over what software is deployed, when or if to upgrade to a new version, which third-party features can be added, which features are enabled, and what security is set up. Your business account is probably run the same way. Most companies see control over their mail systems as a critical part of their business processes, but this control involves costs for both hardware and software as well as for the people who maintain them.

My ISP account is a variation of the client/server theme. I use a mail client on my machine, and my provider hosts the mail on its side. I have no control over the software my ISP is using, and I have to trust the ISP to provide me with access, security, and other features. I do, however, have control over my client—whether I use Eudora, Microsoft Outlook Express, or Netscape Messenger.

This setup is called *outsourced mail*, and it's getting more attention. Most of us use services from AOL or another ISP, and as a result we have limited flexibility. The next step is outsourced mail designed specifically for your business. We've seen several companies offer this (including Critical Path and USA.net), and I expect there will be dozens more in the next year. And some messaging service providers provide other services, such as checking inbound and outbound mail for viruses.

The third option is a pure *Web-based e-mail application*, such as Hotmail or the mail services offered by everyone from Yahoo! to ZDNet. You access them directly from your browser, which means you can use any machine you want. These systems have proven to

be incredibly scalable; they handle huge amounts of mail. To date, however, these applications haven't offered the manageability or flexibility that in-house applications have.

Besides mail, all sorts of Web-based applications are beginning to appear. These include accounting solutions from companies like Net Ledger, Web graphics from companies like Spinfrenzy.com (formerly NetStudio), backup from companies like Connected, and even productivity tools, such as Sun's StarOffice. We've even seen companies like CenterBeam and Everdream, which promise to outsource everything, offer a PC, infrastructure, backup, and basic applications for a small business at a

fixed monthly cost per user. That model still gives you some local and local-server-based applications—but with outsourced setup, management, and backup.

It all sounds good, but if you're like most of us, you're a bit skeptical. Right now, you're probably thinking that this is the return of mainframe time-sharing, and indeed many people are

taking note of the limitations of the outsourced model. Certainly, I have a hard time seeing how you'd effectively run some of the bigger applications like Adobe Photoshop over the Web; and of course, there are plenty of times when I want my applications available on my laptop when I can't connect. Others point out the feeling of security people get from having control over their own applications.

On the other hand, we can all see the tremendous costs that businesses have in installing, upgrading, and managing applications, as well as the support costs and hassles we all face in keeping our technology infrastructure running.

In the end, any of these options—traditional client/server, outsourced server-based applications, or Web-based applications—has strengths and weaknesses. I believe that there is room for all of them, and your choices will depend on what you need. **PC**

Web-based mail and apps sound good, but you're probably a bit skeptical.



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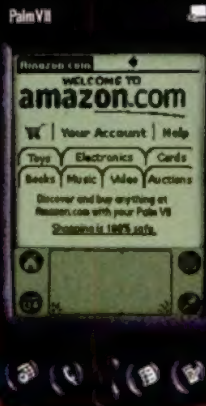
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- John C. Dvorak: Microsoft's dastardly e-mail plot. [Page 83](#)
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Cover photography: Taka Kawachi (bottom), Thom O'Connor (top)



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Printer Impressions

Join us online to learn more about the 55 ink jet, laser, and multifunction printers evaluated in this issue. Plus: Check for up-to-the-minute printer prices.

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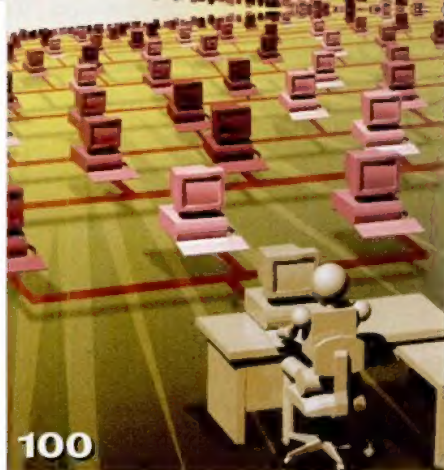
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COVER STORY

100 Send Out for Software

You may never buy another piece of software again; instead, you'll *rent* it. Delivering applications to your desktop via the Internet is emerging as an alternative to the traditional ways. Find out what you need to know and how this may change the way your business works. *By Jim Seymour*

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Finding the right e-mail solution no longer means simply choosing among e-mail servers or deciding whether to take the plunge into groupware but deciding whether to manage your own e-mail at all. *By Frank J. Derfler, Jr.*

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This year's crop of personal printers deliver top-quality output, feature-rich designs, and affordable prices. We test 55 of the latest ink jets, lasers, and multifunction printers for family and SOHO use. *By Alfred Poor*

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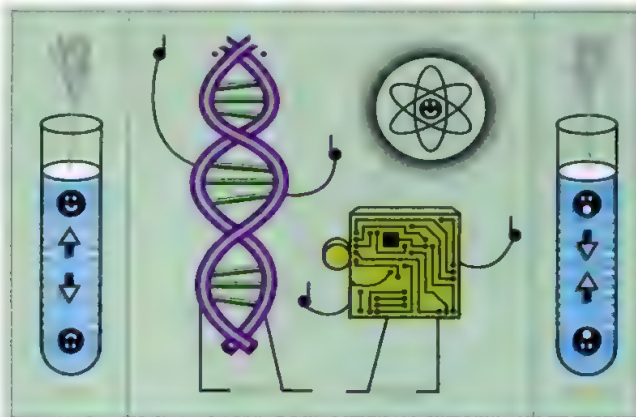
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الحمد لله رب العالمين



DNA Computing

If DNA is the blueprint for life, why can't it be the blueprint for computing? Carter Bancroft, a professor of Physiology and Biophysics at the Mount Sinai School of Medicine in New York, is experimenting with the idea and has come up with a rudimentary biomolecular computer in a test tube. It can't do much yet, but in theory, DNA-based computation can carry out massively parallel operations in a very small space.

DNA has two characteristics that make it uniquely suited to computing. "DNA has been designed through billions of years of evolution to store information very efficiently," says Bancroft. Second, DNA is composed of two complementary strands that can find each other among thou-

sands of other strands.

In Bancroft's lab, synthetic molecules called liposomes form the basis of his Liposome-Mediated Biomolecular Computation architecture. According to Bancroft, biological computing can be cost-effective because the raw materials are plentiful and cheap. And manipulation of the molecules requires only the equipment found in a typical molecular biology lab.

Bancroft explains that the potential of DNA computing isn't so much in 'bit-flipping,' but in solving problems such as searches that require massive parallel processing. He adds, "We're still searching for the killer app for DNA-based computing. Once we solve that, we'll be able to solve the biochemical challenges."

A Microscopic Invention

It looks like a toy microscope, but where's the eyepiece? And what's that long wire coming out of the top housing? It's a USB microscope, and your computer is its viewscreen. A blend of Intel technology and Mattel toy know-how, the Intel Play QX3 USB microscope (\$99 list) is a fantastic new educational toy. With magnifications of 10x, 60x, and 200x, you can see fingerprints, individual fibers in cloth, or the facets of a fly's eye. You can easily record what you see with the USB video camera in the head. The time-lapse ability lets you record the growth of a mold colony or the progress of a tiny insect across a leaf. Kids will have to fight to get this one away from their parents.

OXFORD CLOTH, CLOSE-UP: The Intel Play USB microscope.



of respondents to a recent PC Magazine Online poll told us they spend more than 4 hours per day online. Only 8 percent said they spend less than 1 hour online. Between those extremes, 26 percent spend 1 to 2 hours, 20 percent spend 2 to 3 hours, and 11 percent spend 3 to 4 hours.

Heading Off Viruses

When was the last time you updated your virus definitions? If you're like most people, it's been a while. Now you can leave the campaign against viruses up to your ISP.



US West recently teamed up with Trend Micro, a leading network antivirus developer, to provide e-mail scanning services to individual users and small businesses. US West will use Trend Micro's InterScan VirusWall to scan and clean customers' incoming and outgoing e-mail and attachments. US West says it will be able to block infected messages before they get to their targets.

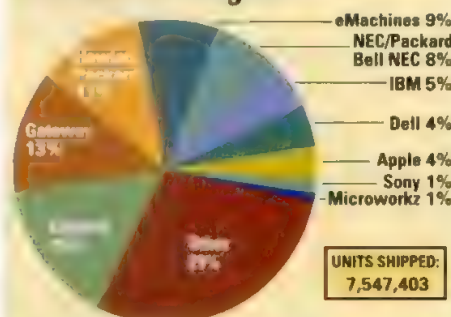
The antivirus service costs \$1.50 per month per account, and it's free for small businesses that already outsource their e-mail to US West. Several other ISPs are expected to partner with Trend Micro and offer antivirus services next year. This is the first of several new services that US West expects to offer in the coming year. Antispam service is another possibility.

A Boom in Bargains

Newcomers eMachines and Microworkz.com Computer rocketed into the top ten home PC makers for the first half of the year, according to consumer shipment figures compiled by market research firm IDC. Fueled by the popularity of super-low-cost PCs, eMachines managed to outship IBM, Dell, and Apple. Ranked tenth, Microworkz recently implemented an internal reorganization to combat shipping problems and customer complaints and also discontinued its \$299 Webster Jr. to focus on an Internet-only system called iToaster.

According to ZD Market Intelligence, sub-\$600 desktops accounted for an incredible 41 percent of unit sales in July, up from 5 percent in March. Systems based on Intel CPUs accounted for more than 45 percent of July unit sales within the sub-\$600 retail desktop market. Systems based on AMD processors accounted for about 29 percent of unit sales.

Home PC Players



Low-cost start-ups eMachines and Microworkz landed among the top ten home PC vendors during the first half of 1999. Figures are for U.S. consumer shipments.

Live Web Filtering

SPs may soon begin offering an extra layer of safety for parents who want to keep their kids away from undesirable Web sites and for employers hoping to cut down on the time employees spend on inappropriate sites. Conventional Web filtering, which matches Web sites against a database of undesirable URLs and keywords, solves part of the problem, but it can't keep pace with the rapid increase in the number of Web sites and the rapid turnover in online content.

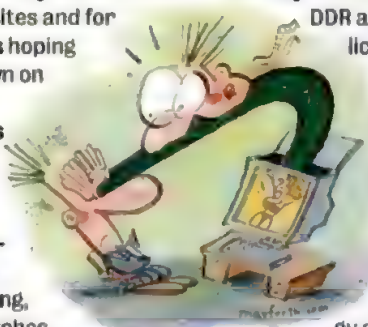
Symantec's newly acquired URLabs has developed filtering technology called Symantec Dynamic Document Review (DDR), which is currently in Symantec's iGear software.

DDR screens in real time by analyzing the context of a passage of text. Symantec recently received a patent on

DDR and has licensed the technology to ISPs that plan to launch it in the next few months.

The benefit is that the technology can keep up with the explosion of sexually explicit, gambling, and other "undesirable" Web sites without having to rely on a database of off-limits URLs.

The technology can also be applied in chat rooms, but would require some fine-tuning. Says Dan Sydow, director of business development at Symantec, "Chat is a bit more challenging because it's more idiomatic than most Web sites."



Microsoft Endorses Online Apps

Technology companies and ISPs are diving into application hosting—the business of providing tools for application service providers (ASPs) who want to rent apps online. Market researchers at the Yankee Group foresee app hosting growing to an \$11 billion business by 2002, up from \$3.1 billion in 1999 (see "Send Out for Software").

Oracle has launched several initiatives designed to encourage ISPs and others to host applications. PeopleSoft recently announced plans to host its own applications online. And after holding out, Microsoft has also

jumped into the ASP fray.

Microsoft's Network Solutions Group plans to begin a pilot program for ASPs that host Microsoft applications, especially Windows 2000 apps. The program will designate ASPs as certified Commercial Service Providers (CSPs). Qwest Communications is the first CSP to sign on.



Full-Service PC Companies



Cheap PCs may be great for consumers, but they're lousy for PC vendors' profits. As prices plummet and computers become commodities, manufacturers are turning to profitable money-making sidelines—such as Web hosting and support services.

Micron recently acquired HostPro, an Internet hosting company where businesses can set up shop on the Web. Compaq offers business customers Internet access via Compaq.net for \$17.99 a month, including 5MB of Web space.

Dell Computer also runs its own ISP, DellNet, and offers subscribers 20MB of online data backup. At the DellNet Web site, anyone can set up a free Web pages or sell an old PC through Dell Auctions. Dell has also been quietly building a giant services business positioned as a single point of contact for any support issue its customers run into.

Meanwhile, start-up everdream is offering small businesses complete IT services, including hardware, software, Internet access, backup, and tech support for a monthly subscription fee.

Top 10 Notebooks

1	IBM ThinkPad 600E (\$2,773)
2	IBM ThinkPad 390E—300 MHz (\$2,065)
3	Toshiba Satellite 2595 CDT (\$1,824)
4	Presario 1245 (\$1,286)
5	IBM ThinkPad 390E—333 MHz (\$2,408)
6	Toshiba Tecra 8000 (\$3,114)
7	IBM ThinkPad 600—366 MHz (\$2,706)
8	IBM ThinkPad 600—300 MHz (\$2,409)
9	Toshiba Portege 7020ct (\$3,230)
10	Compaq Armada 7400 (\$2,169)

Source: U.S. retail and dealer unit sales (street prices), ZD Market Intelligence, July 1999

Clicking for Cash

Here's a new spin on getting paid to surf the Web. At the recently launched www.pointclick.com, you can earn 1 cent for every page you visit on its 250 affiliated sites, including Amazon.com, The Motley Fool, and other popular sites. If you buy something, PointClick tosses in another penny. (Merchants pay PointClick 3 cents for every page view.) Once you earn \$25 PointClick will send you a check.



Online Travel Takes Off



The online leisure-travel industry is expected to grow from \$3.1 billion in 1998 to \$29 billion in 2003, according to market research firm Forrester Research. Yahoo! is the clear leader, closely followed by Travelocity and Expedia.

TOP TEN TRAVEL SITES

1. Yahoo!
2. Travelocity
3. Expedia
4. Southwest
5. Excite
6. AOL
7. Netscape
8. American
9. Delta
10. Infoseek

Source: Forrester Research, January 1999

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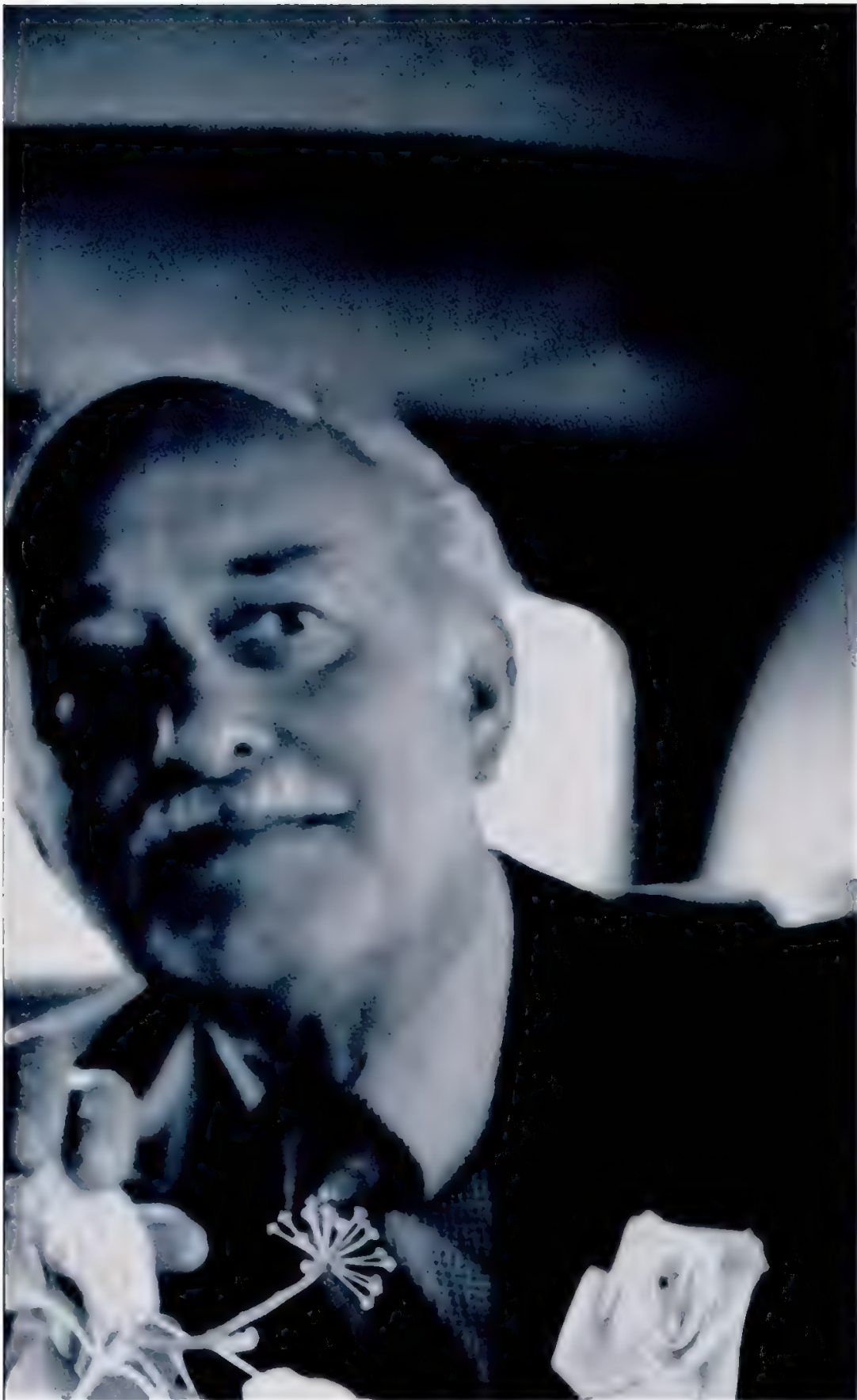


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LETTERS

FULL SPEED AHEAD

After reading "Processors: The Right Speed for You" (September 21), I was a little surprised at the treatment the Celeron was getting—specifically in regard to the floating-point tests. As a 3-D animator, my two main bottlenecks are video card performance and FPU performance. Sure, FPU isn't important to everyone, but the least you could do is compare the Celeron with chips in its performance range, not just in its price range.

DAVID PONTERIO
via the Internet

We did point out that the Celeron more than held its own on our ZD FPU WinMark test, thanks to its full-speed L2 cache. We noted that a Celeron/500 outpaced the pricier Pentium III/500 by almost 5 percent. Still, for high-end applications such as 3-D animation, the Athlon or Pentium III is a better choice because of the improved 3-D performance overall and chip speeds that now far outdistance those currently available in a Celeron.—Ed.

BRING TO LIGHT

A year ago I bought an 11-pound XGA projector for \$7,500 to get the best possible output. In a big room, the image it throws makes it worth every penny and every ounce. So I'm mystified by your preference for the \$3,000 Lightware Scout over the \$4,500 Compaq MP1600 ("5-Pound Projectors," First Looks, September 21).

The Scout has SVGA native output, "just 331" lumens and "pronounced hot spots at the center and edges of the screen." The MP1600 has 598 lumens, outstanding evenness, and native XGA output. Its only imperfection is in video playback. If the cheaper Scout is as you've described, I'd be throwing away my money on it. By contrast, the Compaq MP1600's specs indicate it would provide the quality image I need to make my pitch. This is a clear case of "you get what you pay for."

MIKE SANDMAN
Cambridge, MA

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IM WARS

I loved "The Instant-Messaging Wars Commence," in First Looks of the September 21 issue. You mention how great it is that MSN Messenger users can talk to AIM users, but AOL makes changes to its software about every day, so MSN Messenger users *can't* talk to AIM users. Everyone is always complaining about Microsoft's monopoly, yet nobody ever talks about how AOL has the Internet monopoly.

BRIAN D.
via the Internet

THE REAL DEAL

I disagree with your choice of RealPlayer as the most usable media player ("Surf, Look, and Listen," September 21). I do think its features are more accessible, but to get the best performance, you need to buy RealPlayer Plus. I think Windows Media Player is the best choice, with the most features and the best compatibility.

In this market of multiple players and formats, compatibility is

"I was a little surprised at the treatment the Celeron was getting."

key. Windows Media Player 6.4 takes the lead because of its versatility. This versatility makes it much easier to use as a default and may also allow the end user to have only one media player.

SCOTT MINNIG
via the Internet

IN SHORT SUPPLY

John C. Dvorak mentioned that the IP shortage of a few years ago was fixed by variable IP addressing (Inside Track, September 21). Actually, that problem was postponed by CIDR (Classless Inter-Domain Routing), which uses a bit mask instead of the address class to determine the destination network.

MIKE WALLACE
via the Internet

LITTLE SHOP OF HORRORS

Who wrote your review of Photoshop 5.5 ("A Web-Ready Photoshop," First Looks, September 21), an Adobe regional sales manager? I see three basic problems in this release.

First, there is no documentation to let you know whether this little baby will load over PS 5.0 or next to it (you end up with both PS 5.0 and 5.5 on your machine). Second, there

is no way to find even the most standard third-party plug-ins.

The absolute biggest problem, however, is this: Turn on your computer, activate the Microsoft resource meter, and open ImageReady (you don't have to run the program, just watch the resource meter as the little hog opens). I tried it on two Pentium II machines. In one case, I went from 85 percent free resources to 53 percent; in the other case, I went from 94 percent to 61 percent. Is this what you call a good program?

HOWARD BARTON
via the Internet

NO BIG DEAL

I agree with Jim Seymour ("The Value Proposition," September 21) that \$400 PCs, \$60 scanners, and \$70 color printers are great. But have you bought any ink cartridges for your inkjet printer lately? I just spent over \$80 for two cartridges for our Canon BJC-5000. In less than a year, I'll probably spend more on the cartridges than the original cost of the printer. I think I will be dusting off my old dot matrix printer.

STACEY J. SAUER
via the Internet

ONE MORE TIP FOR PRODUCTIVITY

In his September 21 column, "Five Tips for Productivity," Bill Howard makes a good point. I travel 100,000 miles a year. I could have RoadRunner installed, but I stick with Mindspring, because RoadRunner doesn't have dial-up service. Not every hotel has free Internet access, so I still need an ISP like Mindspring to log on while traveling. And I won't pay \$20 for Mindspring and another \$40 for RoadRunner.

GARY ZEUNE,
Columbus, OH

SEVERAL SCREENS

Your article "Multiple Monitors" (Solutions, September 21) addressed the matter well. Nevertheless, you failed to point out that it is sometimes possible to swap AGP and PCI cards. Although you can't make the swap physically, some BIOSs will let you specify it.

ROBERTO PEREZ
Mexico

ASLEEP AT THE SWITCH

Your reviews of MechWarrior 3 and Heavy Gear 2 ("Feel the Force," After Hours, September 21) were very informative, but I found



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a flaw. You switched their screenshots! Nevertheless, I appreciated all you had to say about today's hottest hits.

AARON HENSELIN
via the Internet

REINVENTING THE WHEEL

The item by inventor Robert Jaeger in your September 1 Abort, Retry, Fail? isn't new. In 1954, while recovering from polio in Harborview Hospital in Seattle, I was using a device that looked exactly like the WristWings photographed with Sigrid Jaeger.

It was supported by pulleys and sandbags for weights above a big old IBM Selectric typewriter. It really worked well, and I have since helped disabled folks with such devices, especially since the advent of the home PC.

TOM CHRISTIAN
Olympia, WA

MAKE NO MISTAKE ABOUT IT

You admitted in Abort, Retry, Fail? (September 21) that you felt "a little dismayed" about the "embarrassing little glitch" in Word 97 for Windows for Dummies in which the table of contents lists a chapter entitled "Spelling and Grammar Made Easy." This was clearly an intentional bit of ironic humor: The title contains both a spelling error and a grammatical error. It's not even subtle! You folks need to get out from behind those monitors once in a while.

JOHN H. BICKFORD
via the Internet

ATHLON VS. PIII

When did the rules change? Just when underdog AMD creates the Athlon and demonstrably beats Intel's highest-speed processors, the venerable ratio of price to performance has given way to other means of determining the winner. In your September 21 First Looks comparison of 600-MHz systems ("Athlon vs. PIII at 600 MHz"), the Dell Dimension XPS T600 took top honors despite the fact that it scored lower than others on your own benchmark tests and was the highest-priced machine of the four reviewed.

Searching the text revealed that what was admired about the Dell unit was such things as Dell's superior ISP offerings with free e-mail, personal Web pages, chat sites, and auction sites. You've got to be kidding. The reviewed machines represent the highest performance hardware available—yet your Editors' Choice reads like a review of Yahoo! services.

DAVE JACKSON
via the Internet

SECURITY GUARD

Thank you for the extensive coverage of security issues in your September 1 issue. I am now testing the Editors' Choice for desktop security,

eSafe Protect Desktop. As an added plus for this program, I can try it out for 30 days free.

I have one question: I access the Internet through a cable modem. How do I protect my desktop from someone invading my home PC through the cable modem network?

I'm sure I'm not the only cable modem user who worries about this issue. With a telephone modem, obviously, one can turn it off or close the connection. The cable modem is always on, which is one of its best features but is also one of the biggest security risks.

KEITH MARLOWE
via the Internet

One of the many personal firewalls available today will allow you to prevent outside intruders from invading your home PC by way of your cable modem. In fact, the product you are testing, eSafe Protect Desktop 2.1, includes such a feature. For additional protection, go to the Control Panel on your home PC, click on the Network icon, then press the File and Print Sharing button and make sure you have disabled the feature that says "give others access to my files." If you want to share files across your home network, you can set passwords for sharing by right-clicking on the drive you want to share and selecting Sharing from the pull-down menu. There you can set password protection and access.—Ed.

HOLLYWOOD HYPE

After reading John C. Dvorak's "PC Paranoia" (September 1), in which he claims that 35- to 50-year-olds use computers less than those older or younger, because people in "the hippie era" were traumatized into computerphobia by 2001: A Space Odyssey and Colossus: The Forbin Project, I checked to make sure the date on the magazine was September 1 and not April 1.

Try Dvorak's test. Ask 35- to 50-year-old teachers who know "next to nothing" about computers if they saw 2001 when it came out. They are, I agree, likely to say yes. But then ask teachers in the same age group who are whizzes at computers the same question. You will get the same answer. So much for crushing logic.

LARRY ERICKSON
Plymouth, MA

SHOP AROUND

In "Where to Shop in PC Land" (September 1), you omitted one of the largest resources that the public uses. How in the world can a story about where to buy a PC not include BestBuy? Of all the "big box" retailers that were mentioned, only CompUSA can hold a candle to BestBuy for selection, prices, and variety of peripherals.

KENT G. ARMSTRONG
Valparaiso, IN

LETTER-PERFECT

Regarding Corel WordPerfect Office 2000 and specifically WordPerfect 9 (First Looks, August): As a longtime WordPerfect user, I have consistently upgraded to each new version as it was made available, and I have always been happy with the improvements. This is not the case, however, with WP9. What a disappointment.

The greatest omission in this new version is the list of synonyms and "related words" in its thesaurus. These had been included in previous versions and are extremely helpful for writing. For some reason, these features are still included in many of the other language modules that come with the program but are missing for English. This is incredible. I have had to uninstall WP9 and return to WP8, waiting to see if these lapses will ever be addressed.

JOHN C. VARGAS
via the Internet

Much like the mayor of my municipality, Microsoft Office 2000 is fat and bloated. Considering that Office is probably used by 90 percent of the market, Microsoft should consider trimming it down to the way people use it, instead of building in features that few people want or even understand. After having used, supported, and taught Microsoft Word since Version 1.0, I find myself being pulled into the world of WordPerfect. The 2000 version is an amazing rebirth of a stalwart product.

CARL H. WEINER
via the Internet

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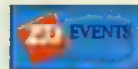
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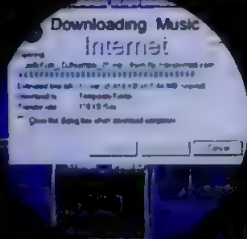
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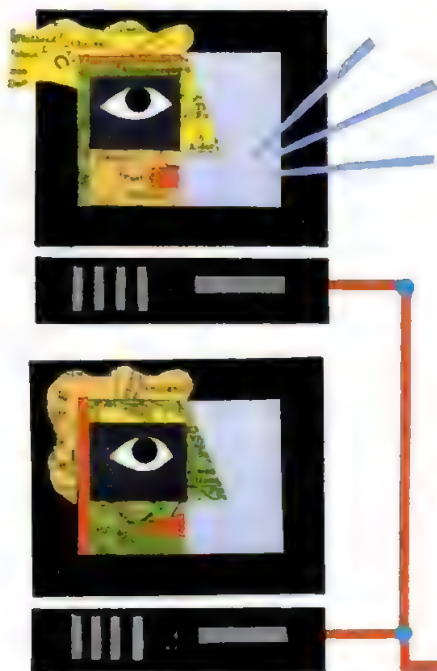


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Nodes for Your Abode

In the very near future, fast home networks will be as accessible as the nearest phone jack.



line networking products ready in time for the holiday shopping season. All of the new products will be backward compatible with the HomePNA's first-generation 1-Mbps standard. Intel currently sells a 1-Mbps product for its AnyPoint Home Network product line. And 3Com recently entered the market with its investment in Epigram, a leading phone-line networking developer.

"The reason you're seeing all these announcements at once is because companies want to get out there ahead of the market," says Karuna Uppal, senior analyst for market research firm The Yankee Group. U.S. households are expected to spend more than \$118

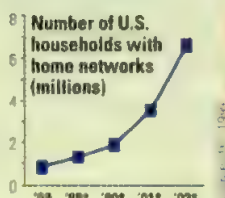
\$10 or \$20 more per connected PC. A kit with two 10-Mbps PCI cards will cost between \$119 and \$129.

In the future, a phone-line network may be just one of several networks coursing through your home. "Right now, people just want to connect two stationary PCs. As people have more and more portable devices, they'll require a hybrid solution," Uppal says. She predicts that the home network of the future will have a phone line or Ethernet backbone combined with several complementary wireless and power-line networked devices.

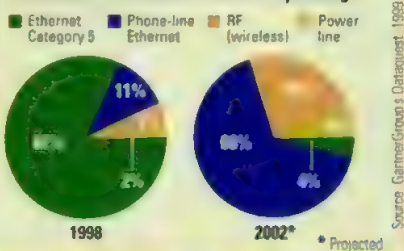
Outside the U.S., wireless networks are likely to be more popular than phone-line networks. U.S. households are abundantly supplied with phone lines and phone jacks, but many other countries, particularly those in Europe and Asia, have strict government regulations about the number and ownership of phone lines. The fact that wireless networks aren't regulated in the same way could make them a very appealing option abroad, despite the higher cost. The HomePNA, however, remains optimistic about the future of home phone-line networks throughout the world. "We're making very good headway in understanding the regulatory environment and we are hopeful that we'll soon implement our technology abroad," says HomePNA chairman Cyrus Namazi. —Sharon Nash

Gaining Momentum

The number of households with networks is expected to soar over the next few years, with the lion's share of spending going to phone-line networking.



Percent of overall home-network spending

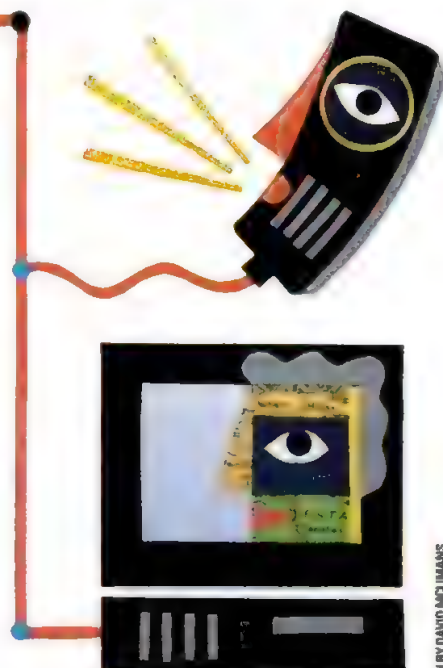


million on home phone-line networks by the end of 1999, according to research firm Dataquest. This amount represents a giant leap from 1998's \$4.8 million. "For people with broadband access, 1-Mbps wasn't fast enough to share the broadband pipe, but 10-Mbps is fast enough to share between two or three PCs," Uppal says. The new, faster networking kits won't be that much more expensive than the 1-Mbps versions, priced about

If you have multiple PCs at home, chances are you'd love to build a home network. But how? Traditional Ethernet networks are fast and cheap, but the thought of ripping out the walls to install the necessary wiring is pretty intimidating. Wireless networks are still expensive, and power-line solutions haven't yet been fully tested.

Phone-line networks are turning out to be the home network of choice because of their simplicity: Just plug the cord into a standard phone jack. Until recently, however, they've provided only 1-Mbps speed, too slow to share broadband Internet access with multiple PCs or enjoy streaming video. The Home Phone-line Networking Alliance (HomePNA), founded by 3Com, AT&T, Compaq, IBM, and Intel, among others, expects to ratify a new 10-Mbps standard by the end of the year.

Several high-speed products compatible with the new standard are currently under development, with 3Com, D-Link, Intel, and Netgear expecting to have 10-Mbps phone-



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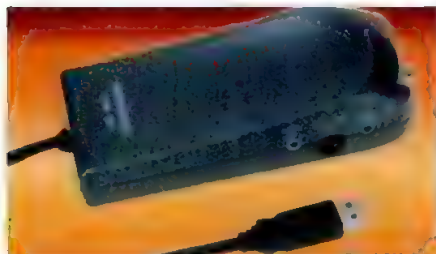
Will USB Finally Have Its Day?

After four years of herky-jerky forward progress, USB (Universal Serial Bus) finally appears to have the wind at its back. Not only is the number of available USB devices—from the exotic to the mundane—growing rapidly, but the new USB 2.0 spec is now finalized.

USB is a technology designed to expand the PC's connectivity via an external port, eliminating the need to open the system chassis. Because USB supports multiple peripherals simultaneously, you can easily run several devices, such as printers, scanners, and digital cameras, from one PC. USB also allows for automatic device detection and installation, although there have been many glitches in these areas.

Today, devices with USB connectivity options are showing up regularly. For example, Nagatech has a USB TV device that lets you watch TV, listen to FM radio, and capture video on your PC. And Compro has developed an external CD-RW drive with USB connectivity for notebook computers.

Intel, Compaq, Hewlett-Packard, Lucent, Microsoft, NEC, and Philips are leading the



▲ **TV TO GO:** With Nagatech's USB TV device, you can watch TV, listen to FM radio, and capture video—even on a notebook.

effort to introduce the USB 2.0 spec. At its recent Developer's Forum, Intel claimed that USB 2.0 will improve performance by about 20 times over current USB capabilities. Besides providing additional I/O bandwidth, USB 2.0 is designed to broaden the range of peripherals that can be attached to a PC.

The other contender for next-generation peripheral connectivity is High-Performance Serial Bus (also known as IEEE 1394 and FireWire), which supports speeds up to 400 Mbps. USB 2.0 should perform somewhere around 200 Mbps to 300 Mbps. (See Bill Machrone's column in this issue.) But IEEE 1394 hasn't had nearly the kind of momentum USB has had, and it's increasingly likely that Intel and other industry leaders will continue to push USB for next-generation peripheral connectivity. —*Sebastian Rupley*



A Snapshot Look at Battery Life



Today's digital cameras produce images that are comparable to or better than average point-and-shoot film cameras. But if there's one area where the digital variety is still at a disadvantage, it's in battery efficiency. Digital camera owners find themselves going through batteries like they go through tissues during allergy season. That's because the LCD viewfinder is power-hungry and the electronic capture of images takes more power than the conventional film approach. To remedy this, many digital camera vendors bundle rechargeable AA batteries and rechargers with their cameras.

PC Magazine Labs strongly recommends using rechargeable nickel hydride or lithium batteries in digital cameras, but those batteries aren't always easy to get. Here we report on the performances of three of the most widely available AA alkaline batteries—Duracell, Energizer, and Kodak Photolife—based on informal tests we performed as a prelude to a digital camera evaluation that will appear in our next issue. We'll report our findings on the battery efficiencies of individual cameras in that story.

For testing, we used two cameras that have varying degrees of energy efficiency. The Nikon Coolpix 900 is representative of digital cameras with efficient battery usage. (It earned Editors' Choice recognition in our January 19, 1999 issue.) The Kodak DC260 is a high-drain device that's more demanding of its batteries. With each camera, we loaded a fresh set of four AA alkaline batteries and cycled through repeti-

tions of ten shots with flash and LCD on, ten shots with only LCD on, and ten shots with flash and LCD off. We shot a single subject under consistent lighting conditions, stopped when the cameras ran out of power, and counted the number of shots the cameras took.

The Kodak Photolife battery was the clear winner in both cameras. Of the three batteries we tested, it's the only one designed specifically for cameras, but you won't find them nearly as easily as the two general-purpose batteries from Duracell and Energizer. If you're at an airport headed for a vacation on a remote island and you realize you need some batteries for your new digital camera, which brand do you choose? You're not likely to find Kodak Photolife in an airport gift shop.

Our test shows that in an energy-efficient camera like the Nikon Coolpix 900, Duracell and Energizer batteries perform about the same. The Duracell is just as good as Energizer for low-drain devices like a Sony Walkman, but the Energizer is better designed for high-drain devices like digital cameras. As shown by the performance difference in the power-hungry Kodak DC260, the Energizer battery is the safer way to go if you don't know the drain characteristics of your camera.

One other useful finding from PC Magazine Labs: Just because the batteries have stopped working in your digital camera doesn't mean you should toss them out. They'll work for a while longer in your Walkman or in any other low-drain device that doesn't require a strong burst of current. —*S. Jae Yang*

The Right Battery for Your Digital Camera

During informal testing with the Kodak DC260 and Nikon Coolpix digital cameras, the Kodak Photolife battery powered more shots than either the Duracell or Energizer batteries



RESEARCH

A Quantum Breakthrough

Scientists at MIT and Los Alamos National Labs recently announced that they've developed the first quantum computer able to simulate a quantum system. The prototype can only count to 4, but its creation is a milestone on the road to real quantum computers.

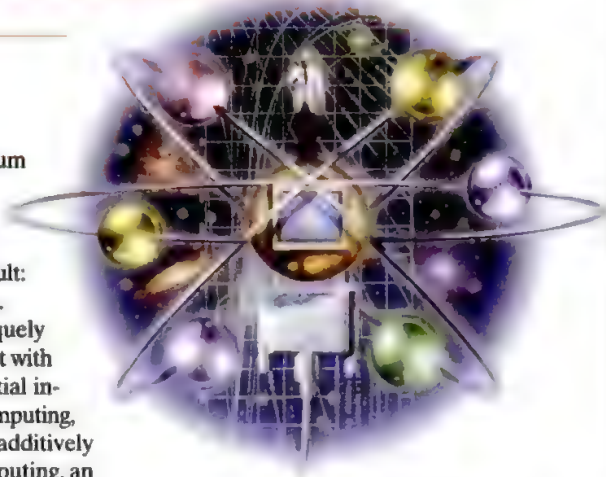
After languishing for more than a decade, quantum research gained momentum in 1994 when Peter Shor, a scientist at AT&T Labs, showed that a quantum computer could be programmed to break an important kind of code exponentially faster than existing computers. The floodgates of research interest opened, leading to the recent breakthrough.

The Nobel Prize-winning physicist Richard Feynman suggested in 1982 the possibility of a new kind of computer that would exploit the quantum properties of matter. Such a comput-

er would represent data as quantum bits (*qubits*) instead of ordinary bits. Qubits aren't limited to being either 0 or 1. Rather, they can be in a mixed state of *on* and *off*. The result: built-in, massive parallel computing.

Quantum computers are uniquely powerful because qubits can interact with each other, giving rise to exponential increases in power. In conventional computing, the power of a processor increases additively with each bit, but in quantum computing, an added qubit multiplies the potential power of the processor, doubling or even quadrupling its capability. Quantum computers would be particularly well suited to helping scientists understand the quantum world through simulation.

Research team member David Cory suggests that there may even be a quantum



improvement to Moore's Law, which states that computer power doubles every 18 months. "In the last two years, we've gone from two qubits to six qubits. This is a sixteenfold increase in power. We may have ten qubits in 2001, another sixteenfold increase," he says. —Marc M. Groz

Bill Bradley's Wired Friends

Presidential hopeful Bill Bradley is a man of contrasts. Raised by Republican parents in a small town in Missouri, Bradley became a Democratic senator from the much more urban state of New Jersey. An all-star athlete in high school, college, and the pros, he was educated at Princeton and Oxford. Another contrast: Although Bradley isn't a cyberfanatic or even much of a high-tech enthusiast, his candidacy has found enormous favor among leading technology execs—who have made significant contributions to his campaign.

This is the third in a series looking at the high-tech leanings of the leading candidates for the presidency. In our issue of December 1, 1998, I noted that Vice President Al Gore's campaign bid for the Democratic nomination is suffused with homage to the Internet age. Texas Governor George W. Bush's race for the Republican nomination is backed by a special Information Technology Advisory Council made up of top officials from firms that include Cisco, Dell, Microsoft, Oracle, and Texas Instruments (as discussed in my September 1 column).

Bradley, who retired from the Senate in 1996 after three terms, would seem on the surface to prefer focusing on more traditional political topics, particularly those that have fueled Democratic campaigns for generations. His speeches concentrate on the bread-and-butter issues of poverty, health care, education, and job security. But Bradley has also been careful to voice his appreciation for the leading industries of the new millennium.

Published reports indicate Bradley is the leading recipient of contributions from the cybercenters of Northern California. A scan of donor records maintained by

the Federal Election Commission shows numerous contributions from top-level executives at computing and communications firms in Silicon Valley and from principals at a variety of venture capital firms.

He has found favor among high-tech donors for two reasons: First, Bradley is very smart, and the leaders of the high-tech field like to believe they're successful because of their own intelligence—so they like to associate with other smart people. Gore and Bush also have Ivy League educations, but neither was a Rhodes scholar as Bradley was.

Second, Bradley—who is not a high-tech devotee—still recognizes the importance to our economy of computing and communications and openly acknowledges the influence of the Internet. For the businessmen among his audience, he hits all the right buzzwords, such as *open markets*, *access to capital*, *low tax rates*, and *investment in R & D*.

In a separate position statement on the Internet (www.billbradley.com), Bradley notes that the Internet gives citizens access to much more information about a candidate than can be found in traditional news sources. He suggests that widespread voter access to the Internet means candidates will have to be more honest and learn to lead from their convictions, because they won't be able to tailor their messages to narrow audiences and individual media. He sums up his thoughts by saying, "I don't know if it's going to be 2000 or 2004, but one presidential election very soon is going to be decided because somebody understood how important the Internet was."

Bradley's approach to high technology and its industrialists is reminiscent of Clinton's: Say the right things in the private meetings in Palo Alto, but concentrate on vote-getting issues of jobs and health. The country's high-tech leaders have prospered during the Clinton presidency; perhaps they're hoping for more of the same from Bradley.



Jake Kirchner

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GRAPHICS CHIPS

nVidia Flexes Its 3-D Muscle

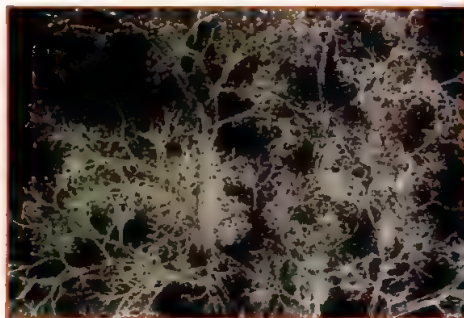
At the recent Intel Developer Forum, graphics chip maker nVidia announced its new 23 million-transistor, 0.22-micron GeForce 256 graphics processor, a chip that represents one of the most significant advances for the 3-D gaming and low-cost workstation markets in some time.

The GeForce 256 executes up to 50 gigaflops (billions of floating-point instructions per second) and is the first mainstream 3-D graphics chip to integrate discrete transform and lighting (T&L) units on the chip. While T&L (also called geometry and lighting) hardware appears in high-end cards from companies such as 3D Labs and Intergraph, moving such capabilities into the mainstream 3-D markets will improve game realism tremendously by removing the T&L processing burden from the host CPU.

With T&L no longer on the CPU, game designers can create polygonally complex characters, models, and scenery. Further, the CPU can now be used to provide more advanced processing for characters, better collision detection, more realistic object and scene physics, and better overall game play. nVidia's 3-D chip calculates transformations of 3-D objects, including their movements, rotations, and scaling, when converting from the 3-D world space-coordinate system to the 2-D screen space-coordinate system. With simple lighting scenarios, the GeForce 256 is around four times faster than a Pentium III/550, according to nVidia.

High-end PCs and retail graphics boards using the GeForce 256 chip started shipping in early October. nVidia plans to move the chip into a 0.18-micron process to reduce manufacturing costs. A version may appear in value systems as early as mid-2000.

Moore's Law states that microprocessor performance doubles every 18 months, but graphics chips are on a far more aggressive curve, with a doubling of performance every six months, or an eightfold speedup every 18 months. Case in point: The nVidia TNT-2 chip shipped in April 1999, and the GeForce 256 will ship in volume six months later. It's expected to have twice the pixel-processing power of the TNT-2, and its 23 million logic-transistor count easily surpasses the 9.5 million logic transistors on the Pentium III. nVidia says the chip has the capability to process 15 million polygons per



▲ **GIGAFLOPS OF FOLIAGE:** The new GeForce 256 graphics processor can render a complex set of polygons into a realistic scene.

second, equivalent to the capability of a 256-processor Cray T3D supercomputer.

Although nVidia is first to market with a chip featuring onboard T&L, it's not alone. S3 recently announced its Savage 2000 and 2000+ chips, which will also have onboard T&L. Both

S3 chips are designed to have faster clock rates than the first-generation GeForce 256, and S3's pricing is likely to be more aggressive in quantity. S3's chips are expected to be shipping in Diamond graphics boards by the holiday shopping season.—Nick Stam

DESKTOPS

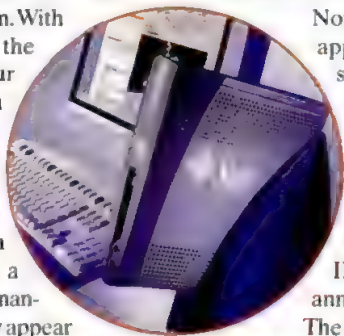
Thin Clients Make a Comeback

Two years ago, the NC (network computer) was all the rage. Some pundits claimed that the era of the PC was over and that thin clients would claim all desktops. Then cheap PCs got a foothold, and NCs suffered a setback.

Now, the trend toward renting applications from application service providers (ASPs) has rekindled the thin-client flame (see "Send Out for Software" in this issue). And thin-client computing got a jump start recently when Hewlett-Packard, IBM, and Sun Microsystems announced thin-client systems.

The idea that simplicity on the desktop and complexity on the server can lead to reductions in overall cost is back in style. But widespread deployment of the architecture, which calls for brawny back-end servers that pack from 4 to 64 processors networked to desktop clients that don't do much more than display applications on-screen, could spell trouble for PC manufacturers that make their money selling powerful desktop PCs to large corporate accounts.

▲ **ENTERPRISE APPLIANCE:** The Sun Ray is powered by Sun's HotDesk architecture, in which all computing is performed on the server.



Compaq, Hewlett-Packard, and IBM have thin-client systems that corporate customers should consider seriously. The Compaq Thin Client and the HP Entria look like 10-inch-high bookends with glowing green eyes. Both systems provide ports for 100-Mbps networking, a PC Card, and USB peripherals. One Entria model runs Linux and has a Netscape browser, the other runs Microsoft Windows CE and doesn't have a browser. One Entria model has a 266-MHz Intel x86 and the other has a 333-MHz x86.

IBM has a new line of eight thin-client models, called the Network Station Family. All of them can run Windows applications as Citrix clients, and individual products have various capabilities for terminal emulation and Java. The IBM systems run on National Semiconductor x86 processors.

Sun recently announced the thinnest thin-client architecture yet, Hot Desk. The client provides an interface that you log on to with a smart card. Every client is attached over dedicated connections to the Sun Ray Enterprise server running on the Solaris operating system, which is then connected over a traditional network to various applications and the data center. You can access both Microsoft applications running on a server or Sun's own StarOffice application suite, which is compatible with Microsoft Office. There's never a need to boot up the system; it's always on.—Frank J. Derfler, Jr



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* Results based on a *PC Magazine* (July 99) "Desktops and Notebooks Service and Reliability" survey in which Quantex received an "A" rating in the Desktops—Overall Use category, besting out Gateway and Compaq which received ratings of "C" and "D" respectively. Quantex received an "A" rating by scoring significantly higher than average in all 5 test categories. See *PC Magazine* July 99 for details.

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Globalize Your Web Site

By Tom Giebel

Although the fact is clearly stated in its name, many site builders forget that the World Wide Web is globally accessible. In fact, market research firm Computer Economics predicts that the number of non-English speakers using the Web will surpass English speakers sometime in 2002. But language isn't the only barrier to making your site accessible overseas. There are also technical issues to consider as well as logistical and cultural hurdles to pass. Here are some suggestions that will help you give your site international appeal.



Translate Your Content

► Making your site available in a variety of languages is a great way to welcome international visitors. Automated language-translation software is getting better all the time, and there are a number of sites on the Web that offer this service for free. For a quick and dirty translation, check out the free services from **FreeTranslation.com** (www.freetranslation.com) and **AltaVista** (<http://babelfish.altavista.com>), both of which translate individual phrases and entire Web pages into a variety of languages.

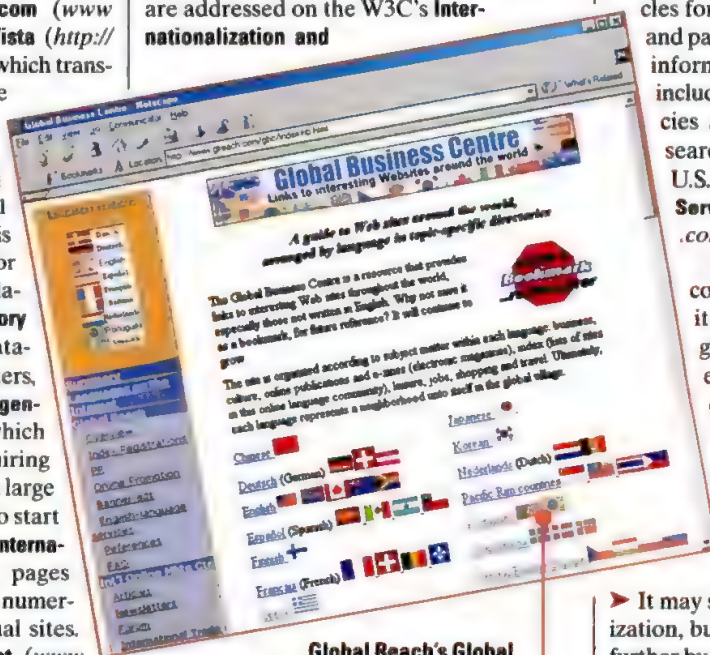
Translation software is good enough to give you a general meaning, but human translation is still the most accurate method. For help in finding competent translations, look to the **Aquarius Directory** (<http://aquarius.net>), a huge database of translators and interpreters, or **Glenn's Guide to Translation Agencies** (www.glennsguide.com), which offers useful advice for acquiring translation services. If you have a large site to translate, you may want to start at the Internet Society's **Babel—Internationalization of the Internet** pages (www.isoc.org/8080), which offer numerous tips for creating multilingual sites. You may also find **WebBudget** (www.webbudget.com) helpful for estimating translation costs.

Create Multilingual Pages

► Now that your content has been translated, you need to make sure your Web pages are coded with the proper character sets to display the particular language. For an overview of how to specify languages in your Web pages, see the chapter on internationalization in the World Wide Web Consortium's

(W3C) **HTML 4.01 Specification** site (www.w3.org/TR/html40/struct/dirlang.html).

The **Unicode Standard** (www.unicode.org) enables Web browsers to encode all of the characters used for the written languages of the world, and the site contains handy character code charts for each language. Additional technical issues for multilingual sites are addressed on the W3C's **Internationalization and**



Global Reach's Global Business Centre can direct you to a variety of resources around the world that can help localize your site.

Localization site (www.w3.org/International). "The Localization Process: Globalizing Your Code and Localizing Your Site" (<http://msdn.microsoft.com/workshop/management/intl/locprocess.asp>) is a Microsoft white paper that includes a helpful, step-by-step guide.

Get an International Address

► Most people are used to URLs that end in .com, but if you maintain multiple sites in different languages, you may want to register additional country-specific, top-level domains—such as .fr for France or .jp for Japan. You can register for these domains through Network Solutions' **idNames** service (www.idnames.com), or you can go directly to the specific registrar for the domain you choose. Lists of country codes and links to their specific registrars can be found at both the **Internet Assigned Numbers Authority** (www.iana.org), and the **Internet Corporation for Assigned Names and Numbers** (www.icann.org).

Deliver the Goods

► Both **United Parcel Service** (www.ups.com) and **Federal Express** (www.fedex.com) offer extensive service guides for shipping goods overseas. You'll find export documentation requirements, lists of prohibited articles for most countries, cost calculators, and package-tracking services. For more information on shipping overseas, including links to foreign customs agencies and official foreign postal code search engines, pay a visit to the U.S. Postal Service's **Global Delivery Services** Web site (www.uspsglobal.com/global).

While it's best to leave currency conversion up to your bank or credit card company, you may want to give international visitors converted prices for information purposes. **Oanda's Currency Site** (www.oanda.com) offers a customizable currency-exchange calculator you can include in your own Web pages.

Localize Your Site

► It may sound like the opposite of globalization, but localization takes things a step further by adapting content to local cultures. This means adapting things like times and dates, units of measurements, and more complicated items like cultural symbols that don't translate well. Localization demands a certain amount of research, and sites like the **Global Information Network** (www.ginfo.net) and **Global Business Centre** (www.greach.com/gbc) can help. You may also want to consider joining the **Localisation Industry Standards Association** (www.lisa.unige.ch) for access to a network of specialist companies. PC

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GIGABUYS
BY DELL

The **BIG GUYS** sales process.



PRE-SALE



SALE



POST-SALE

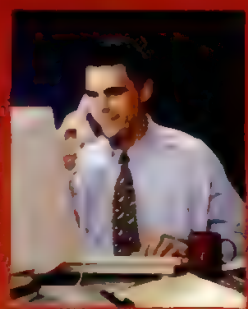
The **SAG** sales process.



PRE-SALE



SALE



POST-SALE

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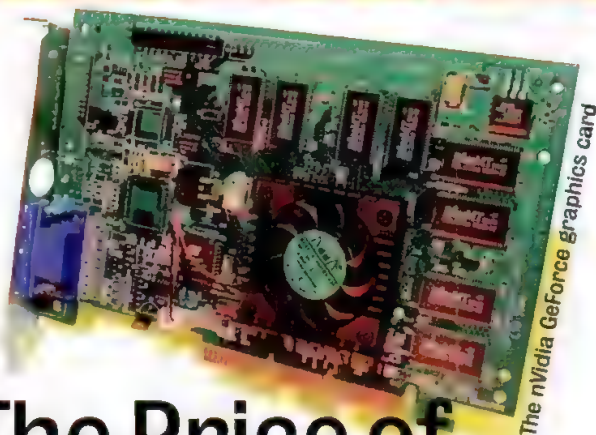
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The nVidia GeForce graphics card

The Price of Performance

Intel's 820 chip set has been delayed again, but our story shows how it will stack up.

By Cade Metz

Just as we were getting used to seeing virtually the same collection of hardware at the core of every high-end desktop PC, the market has suddenly diversified. Following the introduction of the AMD Athlon processor last month and the recent arrival of new core-logic chip sets from Intel and Via, PC manufacturers are using more than just the Pentium III and Intel's long-standing 440BX chip set in their upmarket desktops.

With such vendors as Compaq and IBM offering Athlon, which has reached 700 MHz and gen-

erally outperforms even the fastest Pentium III, high-end users should find choosing a CPU much more difficult. And if they choose the Pentium III, users may face even more difficulty deciding on a chip set with new ones from Intel and Via vying to displace the BX.

No other chip set has gotten as much attention recently as the Intel 820. Code-named "Camino," the 820 is designed for use with the current Pentium III processors, as well as the company's upcoming "Coppermine" processors, which will be both faster and smaller (0.18 microns). The 820 offers several advantages over the BX. It supports a faster kind of memory known as Rambus DRAM (RDRAM) that operates at 600, 700, or 800 MHz. Though there is no doubt RDRAM can outperform the SDRAM found in most systems, Rambus has been controversial because it costs significantly more than conventional memory.

The 820 includes a set of tech-

nologies that reduce bottlenecks between the chip set and key system components including the processor (133-MHz front-side bus), graphics (4X AGP), and hard disk (UltraATA/66). Together, these enhancements should boost performance on certain types of high-end applications.

As our story went to press, Intel discovered a technical flaw in the implementation of the 820 chip set. In systems that contain three memory slots, Intel's stress tests have produced memory errors. To correct this problem, Intel and others may have to



The controversial Rambus DRAM (3 slots)

redesign motherboards so that they have only two memory slots, which would also reduce the total capacity of 820-based systems to only 512MB DRAM.

Both the 820 and systems based upon it have been delayed indefinitely, although Intel may announce it in late October when the company will reportedly launch Coppermine. The 820-based systems reviewed here, the Compaq Presario 5900R and Dell Dimension XPS B600, both had motherboards with three RIMM slots and will not be shipping by the time you read this. The memory problem, however, should not affect performance, so our story should accurately reflect the performance and features you can expect from 820-based systems as they

GET THE PICTURE:

The Toshiba MediaStar TLP651 is a light-weight projector with a built-in document camera. *Page 53.*



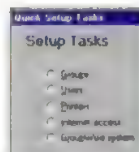
ALL TOGETHER NOW:

NeoPlanet 5.0 combines the most popular Internet functions into a single desktop application. *Page 57.*



NET GAIN:

Small networks are a breeze to set up and maintain with Novell Small Business Suite 5. *Page 73.*



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WELL-EQUIPPED: The Presario's extras include a Klipsch speaker system.

compare to competitors. Our tests involved four PCs—from Compaq, Dell, IBM, and Micron. The Compaq Presario 5900R and the Dell Dimension XPS B600 included 600-MHz Pentium III processors, 820 chip sets, and PC800 (800-MHz) Rambus DRAM.

Though also equipped with a Pentium III/600 processor, the Micron Millennia MAX 600 used a Via chip set and 133-MHz Virtual Channel memory.

To make things really interesting, we also tested a system built around AMD's 700-MHz Athlon processor. The IBM Aptiva S Series 870 also included the AMD-750 chip set, 200-MHz system bus, and 100-MHz SDRAM.

With its faster Athlon processor, the Aptiva performed best on our standard benchmark tests nearly across the board. When you are simply running typical business applications such as Microsoft Office, however, all of these systems perform at a very high level regardless of their processors and chip sets. Looking forward, though, the 820 architecture will offer real gains when performing multiple tasks, especially those involving streaming data such as multimedia and network traffic.

Chip-Set Challenge

To take a close look at the 820, we used two reference systems, one based on the BX chip set with SDRAM and the other

based on the 820 chip set with RDRAM but otherwise with nearly identical components.

On standard benchmark tests, for typical business applications, the 820's faster bus, faster memory, UltraATA/66, and AGP 4X afford almost no performance improvement. In fact, the reference systems yielded nearly identical scores on CPUmark and Winstone.

To test the true strengths of the 820, we developed three specialized performance tests. In all three cases, the 820 reference system handily outperformed its BX counterpart, demonstrating the capabilities of UltraATA/66, 4X AGP, and the 820 chip set.

Generally, the real-world systems in our story that are based on the 820 chip set—the Compaq and Dell units—delivered performance that was similar to that of our reference systems. In other words, on standard business applications you won't see much difference, but on more system-intensive tasks, these machines really shine.

Intel Alternatives

In an attempt to avoid the cost increases associated with Rambus but still match the performance of 820-based systems, some vendors have turned to chip sets or processors from other companies.

For example, Micron has adopted the Via Apollo Pro133 chip set, which uses less-expen-

sive Virtual Channel memory. The Millennia certainly holds its own on typical business applications, with its Winstone and CPUmark scores virtually matching those of the Presario and the Dimension.

The Aptiva, with its Athlon/700 and its AMD-750 (IronGate) chip set, scored equal to or slightly better than the BX system on our specialized performance tests but not as well as the 820-based systems. Keep in mind, however, that the Aptiva outperformed its three Pentium III competitors by 9 percent, on average, on Winstone and 46 percent on CPUmark.

In Conclusion

As our specialized performance tests suggest, the 820 chip set delivers on Intel's promise of improved performance under certain circumstances: opening and saving large files such as Photoshop images, video editing, transferring large batches of images from a digital camera to your PC using USB, and downloading big files over fast connections. If you perform any of these tasks regularly, the 820 makes sense for you today. And even if you don't, the 820-based systems are worth considering if you can afford to pay extra for some room to grow.

Having said that, the alternatives to the 820 from IBM and Micron provide similar or, in several cases, better performance on

today's business applications. So you'll get the most bang for the buck by skipping 820-based systems—at least until RDRAM prices come down.

Compaq Presario 5900R

The Compaq Presario 5900R (pricing not finalized) is built around the Pentium III/600, the 820 chip set, and RDRAM memory. With these specs, the Presario is an able performer, but it is also loaded with all the extras.

Like previous Presarios, this system comes with a slick Compaq.net Internet wizard (which affords 100 hours of free access) and a large number of help tools. It's quite easy to set up, use, and—if need be—repair, and its plastic housing slides off easily, allowing you to add or remove components quickly.

But this Presario is already well equipped. The system's core hardware is augmented by a DVD drive, a CD-RW drive, a keyboard with built-in audio and Internet controls, and a THX-certified Klipsch Pro Media speaker system. The latter may take up a lot of space, but it affords brilliant sound, matching the quality of the system's DVD playback. Compaq also provides front and rear USB and IEEE-1394 (FireWire) ports.

With the exception of the Athlon-based IBM system, the Presario performed as well as



CUTTING-EDGE: The Dell Dimension XPS B600 merges the latest technology from Intel and nVidia.

any system in our roundup. Using the 820 chip set, it can better handle concurrent data streams than the IBM.

Compaq received poor scores on our latest Service and Reliability Survey and backs the Presario with only a one-year warranty, but that does include on-site service. The company also provides copies of Mi-

crosoft Office 2000 Small Business Edition, Money, and the Encarta Encyclopedia.

Compaq Presario 5900R. Pricing not yet finalized. With Pentium III/600 CPU, 820 chip set, 128MB of RDRAM, 34GB hard disk, 19-inch Compaq monitor. Compaq Computer Corp., Houston; 800-888-0220; www.compaq.com.

Dell Dimension XPS B600

In addition to using the 820 chip set and RDRAM memory, the Dell Dimension XPS B600 (pricing not finalized) is one of the first machines—along with the Micron Millennia MAX 600 to use the long-awaited nVidia GeForce 256 graphics card.

Offering a 256-bit rendering

engine, the GeForce should improve the Dimension's ability to handle complex 3-D designs. But this has yet to be seen (or tested using 3D WinBench). The card's drivers and Microsoft DirectX 7 interface weren't ready in time. Running 2-D software, the Dimension performs on a par with the Compaq and Micron systems reviewed here, but

BENCHMARK AND PERFORMANCE TESTS

High-End Desktop PCs



For this story, our standard benchmark tests tell only half the tale. To test the added capabilities of Intel's new 820 chip set, UltraATA/66, and 4X AGP, we had to devise a second set of performance tests. The results of these two suites of tests were strikingly different.

Benchmark Tests

The IBM Aptiva S Series 870, based on the AMD Athlon/700 processor, earned top scores on both the ZD Business Winstone 99 and ZD 3D WinMark 99 tests by narrow margins. But in two areas the Aptiva really pulled ahead of the pack, beating the average ZD FPU WinMark 99 score by 26 percent and the average ZD CPUmark 99 score by 46 percent.

We didn't publish 3D WinBench results for the Dell and the Micron, because the included nVidia GeForce 256 graphics card wasn't yet shipping. Once the nVidia GeForce 256 ships, we will update both systems with the final drivers and Microsoft DirectX 7 and post the results online.

Performance Tests

Intel's new 820 chip set was designed to increase system bandwidth and improve performance. It should be able to handle concurrent data streams more efficiently. To deter-

mine whether the 820 chip set really delivered better performance under these conditions, we devised a set of three additional performance tests.

To eliminate the possibility that different components could influence the outcome, we assembled 820 and BX reference systems—each with a Pentium III/600, a 4X AGP-capable Diamond Viper 770 card using nVidia Detonator v2.08 drivers, a Maxtor DiamondMax Plus 6800 Model 92732U 27GB, 7,200-rpm UltraATA/66 drive, and a 3Com 10/100 NIC. Each system had 128MB of RAM, with SDRAM on the BX system and Direct RDRAM on the 820 system.

Concurrency Tests: We downloaded a large binary file from a Windows NT 4.0 server using FTP across a 100-Mbps Ethernet network while simultaneously running the Business Winstone 99's Microsoft Office 97 suite. The 820 reference system produced a 7 percent better result than the BX system.

UltraATA/66 Tests: We measured the time it took to load and save a large TIFF file (64MB). We were pleased to see that the UltraATA/66 channel in the 820 reference system and the Micron made a large difference.

AGP 4X Test: This test uses up to 12.4MB of 32-bit textures and averages 7MB across all frames displayed. We ran the Diamond Viper boards in our reference systems at a very high resolution (1,600-by-1,200), tripled buffered, with 32-bit color and 32-bit Z, which consumed over 29MB of frame-buffer memory (out of 32MB installed). Again we were impressed by the gains in the 820's 4X AGP interface.—*Analysis by Nick Siam and Laura Cox*

BENCHMARK TESTS

High scores are best

Bold type denotes first place.

	ZD Business Winstone 99	ZD 3D WinMark 99 (16-bit)	ZD 3D WinMark 99 (32-bit)	ZD Business Graphics WinMark 99	ZD Business Disk WinMark 99 (thousands of bytes/sec)	ZD CPUmark 99	ZD FPU WinMark 99
Compaq Presario 5900R	26.0	1,080	807	198.0	4,430	44.0	2,980
Dell Dimension XPS B600	27.2	N/A*	N/A*	227.5	5,015	44.0	2,980
IBM Aptiva S Series 870	28.9	1,190	818	304.0	4,800	64.2	3,790
Micron Millennia MAX 600	26.5	N/A*	N/A*	199.5	4,870	44.4	3,040
Intel BX reference system	26.9	1,070	800	229.0	4,320	43.9	3,030
Intel 820 reference system	26.8	1,080	809	232.0	4,650	44.0	3,030

PERFORMANCE TESTS

▲ High scores are best

▼ Low scores are best

Bold type denotes first place.

	Concurrency Tests Large-File Download (min:sec) ▼	Business Winstone: MS Office Suite (min:sec) ▼	Concurrent Download and Winstone (min:sec) ▼	UltraATA/66 tests Adobe Photoshop Load (seconds) ▼	Adobe Photoshop Save (min:sec) ▼	AGP 4X test ZD 3D WinBench Large Textures (fps) ▲
Compaq Presario 5900R	8:35	5:02	8:57	N/A**	N/A**	N/A**
Dell Dimension XPS B600	9:09	4:44	7:02	N/A**	N/A**	N/A**
IBM Aptiva S Series 870	9:11	4:47	7:11	37.0	2:30	16.4
Micron Millennia MAX 600	11:40	5:01	8:06	35.0	1:33	N/A*
Intel BX reference system	9:42	4:52	7:37	41.4	2:47	16.4
Intel 820 reference system	8:47	4:44	7:04	34.3	1:35	21.6

N/A*—Not applicable. The system could not complete this test, because its graphics card drivers were not final.

N/A**—Not applicable. We did not run this test on this system.

FIRST LOOKS

below the level of the Athlon-based IBM.

Naturally, the Dimension is not only fast but easy to use. It rivals the Presario in this respect, offering a complete set of help tools, a convenient Internet access wizard, and a keyboard equipped with audio and Internet controls. The system's price includes a year of Internet access from Dell.net.

The Dimension also includes Harman Kardon 595 speakers, a DVD drive, an internal Zip drive, Microsoft Works software suite, and a three-year warranty with a year of on-site service. **Dell Dimension XPS B600.** Pricing not finalized. With Pentium III/600 CPU, 820 chip set, 128MB of RDRAM, 20GB hard disk, 19-inch Dell monitor. Dell Computer Corp., Round Rock, TX; 800-388-8542; www.dell.com.

IBM Aptiva S Series 870

The only system in our story without Intel inside (either a processor or a chip set), the IBM Aptiva S Series 870 significantly outperformed every other machine in our roundup on our standard benchmark tests. Such is the strength of Athlon. The Aptiva is one of the first systems to use the 700-MHz Athlon, a chip that offers not only a faster clock speed than the Pentium III but, seemingly, a more adept architecture as well.

The Aptiva's chip set doesn't support 4X AGP and doesn't handle concurrent data streams as well as the Dell and Compaq systems reviewed here, but such issues hardly hinder its ability to run common business applications. The Aptiva substantially outscored its three Pentium III/600 competitors on Winstone, CPUmark, and FPUMark (a measure of raw floating-point performance).

Unfortunately, the unit we tested wasn't very stable. We had problems running our benchmark tests, running IBM's DVD drive, and even booting the machine on occasion. IBM says there was a flaw in the system BIOS and that an update, which we did not receive in time for testing, would correct the problem.

If IBM irons out the stability problems, this could be a brilliant home PC. The model we tested (\$3,800 street) included a gorgeous digital flat-panel monitor; with a standard, 19-inch monitor, the system costs \$3,190 street. Other notable features include an ADSL modem as well as a standard 56K modem, a CD-RW drive as well as the DVD drive, and two stereo speakers. The Aptiva's help tools are fairly useful; its Internet-access wizard is much improved; and its software bundle (including Lotus SmartSuite Millennium Edition) is respectable.



PC WITH A VIEW: Our Aptiva included a gorgeous flat-panel display.



ALTERNATE ROUTE: Micron has opted for the Via chip set in its desktop.

IBM includes only a one-year warranty with the system and no on-site service, but the company did receive A grades on our most recent Service and Reliability Survey. On the whole, the Aptiva is a mixed bag. But one thing is certain: It's fast.

IBM Aptiva S Series 870. Street price: \$3,800. With Athlon/700 CPU, 128MB of SDRAM, 20.4GB hard disk, 15-inch IBM flat-panel display. IBM Corp., Armonk, NY; 800-426-7235, ext. 4340; www.pc.ibm.com/us/aptiva.

Micron Millennia MAX 600

Without doubt, Micron has found a viable alternative to Intel's fledgling 820 chip set. Using the Via Apollo Pro133, the Millennia performed just as well as the typical 820 system on nearly all of our benchmark tests. The Apollo can't handle concurrent data streams as well as the 820, but this is a minor drawback—especially when you consider the Millennia's sub-\$2,500 price tag.

The Millennia is a majestic tower PC with a side panel that slides off easily to reveal the system interior. Regrettably, getting the panel back on is not as easy. Otherwise, the system is fairly easy to use, with good documentation, a few help tools, and a customized Internet-access wizard. Micron includes 45

days of free Internet access.

Like the Dell unit in this roundup, the Millennia we tested used an early version of the new nVidia GeForce graphics chip that couldn't run our 3D WinBench tests. That said, the system performed remarkably well. Equipped with the Apollo 133-MHz front-side bus, 4X AGP and UltraATA/66 protocols, and Virtual Channel memory, the Millennia produced Winstone scores comparable with those of the Compaq and Dell machines.

Micron further equips the system with a DVD drive, a CD-RW drive, and the massive Creative Labs Digital Theatre. Consisting of five speakers, a subwoofer, a control box, and innumerable cables, the Digital Theatre isn't easy to set up, and it eats up a lot of space, but it sounds great.

The Millennia is backed by Micron's standard warranty (five years for CPU and memory, three years for parts and labor, and one year of on-site service). On top of all this, we expect the Millennia to cost several hundred dollars less than comparable 820 systems.

Micron Millennia MAX 600. Direct price: \$2,490 with Pentium III/600 CPU, 128MB of Virtual Channel memory, 27GB hard disk, 19-inch Micron monitor. Micron Electronics, Nampa, ID; 888-634-8799; www.micronpc.com. **PC**



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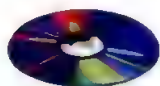


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Quark Killer?

Adobe's new high-end desktop publishing tool, *InDesign 1.0*, attempts to unseat *QuarkXPress*.

By Luisa Simone

Among design and prepress professionals, it's common knowledge that *QuarkXPress* owns the high-end desktop publishing (DTP) market. But the release of Adobe *InDesign 1.0* (\$700 street, \$300 through December) threatens Quark's hegemony. *InDesign* is *not* an update of *PageMaker*, which Adobe has repackaged as a corporate publishing tool. Instead, *InDesign* is targeted at professional publishers who want to design on the desktop but print on a commercial offset press.

The program borrows many ideas and tools. Like the rest of the Adobe family of products, *InDesign*'s interface consists of dockable tabbed palettes, and the program supports standard keyboard shortcuts. And like *PageMaker*, *InDesign* can easily import text and pictures using the straightforward Place command. *InDesign* contains polygon and bezier drawing tools, as you find in *Illustrator*. And like *QuarkXPress*, *InDesign* supports a frame-based design metaphor and a single pasteboard that contains all of the pages in a document.

Beyond the Basics

Adobe hopes to win converts from *QuarkXPress* by upping the ante on core DTP functions. Instead of requiring designers to build customized H&J (hyphenation and justification) profiles, *InDesign* offers automated functions that can dramatically improve the appearance of type.

For example, the multiline composer can adjust word spacing and line breaks by considering all of the text in a paragraph. And *InDesign*'s optical kerning and optical margin alignment can evenly space the letters in a word composed of wildly different fonts.

Like *QuarkXPress*, *InDesign* offers multiple mas-

► TAKE YOUR PICK:

The direct selection tool (highlighted in the toolbox) lets you subselect individual objects within a group.



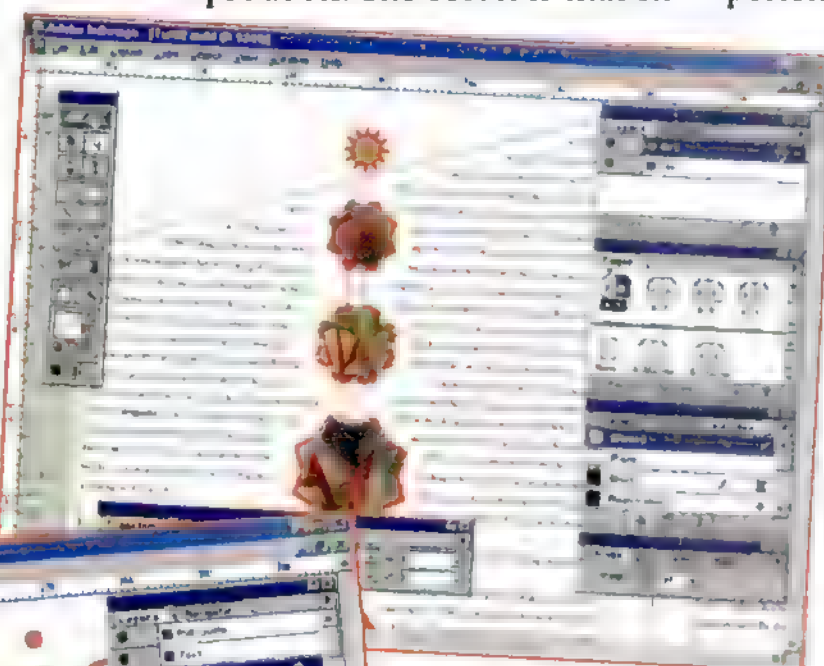
ter pages with text and picture placeholders. But *InDesign* also lets you set up hierarchical relationships between masters, so changes made to one master ripple through to all subordinate templates.

InDesign offers lots of productivity enhancements, including unlimited Undo, document-wide layers, and a library palette. Designers will love two seemingly small features: Multiple views of the current publication mean you can edit the layout on one page while watching how it affects text flow on a subsequent page, and since *InDesign* treats ruler guides as ob-

jects, you can use the Transform palette to position guides accurately or store them on a layer.

For cutting-edge design effects, look no further than *InDesign*'s ability to stroke and fill text characters with color or gradients. Even after you rotate, flip, skew, or mask text, it remains editable.

InDesign shares several key technologies with other Adobe products. The result is that *In-*



◀ BY THE LETTER:

InDesign's advanced type treatments include automated drop caps, gradient-filled text, optical kerning, and optical margin alignment.

Design can preserve line breaks and simulate the appearance of a missing font, render and magnify EPS data on screen, edit the bezier curves in an imported *Illustrator* file, and deliver color output that is consistent with Adobe *Photoshop*.

Optimizing Output

At output time, *InDesign* performed well. The program exports PDF files directly, with no need to install Distiller. And when printing, *InDesign* can produce a generic PostScript file for your service bureau and subsample data to send only the visible part of an image within a clipping path.

Web output is more limited. Though the program supports Cascading Style Sheets, you have no provisions for image maps or hypertext.

InDesign has its share of inconsistencies, glitches, and bugs. For example, the direct-selection tool, which lets you edit bezier curves or subselect grouped and nested objects, will confuse anyone who isn't an experienced *Illustrator* user. You

can't lock a clipping path to the object it masks. Printing to a PCL printer (instead of a PostScript 2 device) disables all the advanced printing options. And there is no context-sensitive help.

There are many functions that *InDesign* simply doesn't offer. Most notable is the lack of long document support: You can't create a

table of contents, index, or cross references. Nor does Adobe offer an editorial management system such as *Quark Publishing System*. In addition, *InDesign* has no host-based trapping, can't place text along a path, doesn't support multi-ink colors, doesn't justify text vertically, and has no table editor. But *InDesign*'s modular, extensible program structure will enable Adobe or third-party developers to add these features quickly.

We expect the publishing industry to reserve judgement on *InDesign* until it proves itself in a production environment. But given the performance of its core design tools and the support of third-party developers, *InDesign* is poised to give *QuarkXPress* a run for your money. **Adobe InDesign 1.0.** Street price: \$700 (through December 1999, \$300). Requires: Pentium II processor, 48MB RAM, 75MB hard disk space, Microsoft Windows 98 or NT 4.0 with Service Pack 4 or later. Adobe Systems Inc., San Jose, CA; 800-562-3623; www.adobe.com.

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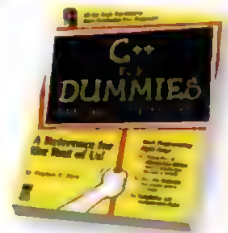
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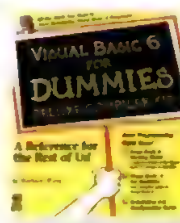
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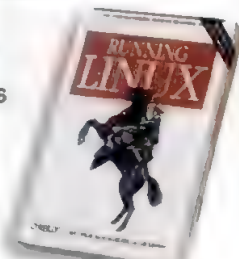


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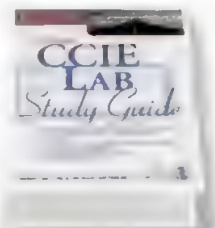


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FIRST LOOKS

Tap and Shoot

The Casio Digital Camera Card converts the Casio Cassiopeia PDA into a digital camera.

By Daniel Grotta and Sally Wiener Grotta

What a great idea—attach a camera to a PDA, and you have pictures to go. The Casio Digital Camera Card Model JK-710DC (\$299 list) connects to the popular Cassiopeia color PDA (\$599 list), transforming it into both a digital-still and multimedia camera. You get convenience combined with instant image capability, but image quality is only fair.

The camera module is a small, lightweight cylinder with a tiny lens in the middle and a CompactFlash interface on the bottom that plugs into the top of the Cassiopeia PDA. The f2.8 lens can swivel 180 degrees and has a depth of field from about 1 inch to infinity, but it also can be manually focused down to around 2 inches.

Since the PDA has only one (Type II) CF slot, all images must be saved to the PDA's internal memory. Depending on the image resolution, compression level, and free storage space available, you can record approximately 100 to 500 images and about 10 minutes of video.

Recording is initiated by pressing the stylus to the touchscreen shutter button or by pressing a silver button on the side of the PDA. Shooting can be awkward, and some of the icons are not easily comprehensible, making the interface cluttered and confusing.

Depending upon the mode, saving a still image takes either 3 seconds or 7.5 seconds. Still-image resolution is limited to 640-by-480; images are saved as JPEGs. The only adjustments you can make are selecting among three compression levels, auto or manual white balance,

are recorded at 10 fps at 320-by-240 or 160-by-120, in Casio's proprietary CMF file format.

Downloading to your PC is both simple and tedious, because the Cassiopeia's software does not include an acquire driver. You must use Windows Explorer to bring up the device's folder, then manually drag the files into your PC. You can't transmit in real time, because the PDA communicates via a CF modem, which requires first removing the camera module from the PDA.

Still-image quality is acceptable for a VGA camera: Colors tend to posterize and details are soft. Because we couldn't convert the CMF files to a standard format, we were unable to evaluate the video clips on a PC (a conversion utility will be available on Casio's Web site).

What makes the Cassiopeia camera a useful and versatile business tool is its small size, its power, and its versatility. For many, these features will more than offset the camera's inadequate software, frustrating interface, and mediocre image quality.



TOP THIS: The Camera Card fits in the CompactFlash card slot on top of the Casio Cassiopeia PDA.

Casio Digital Camera Card Model JK-710DC. List price: \$299. Requires: Casio Cassiopeia. Casio Inc., Dover, NJ; 800-962-2756; www.casio.com.

Live-Action Projector

The lightweight Toshiba MediaStar TLP651 LCD projector includes a document camera.

By Alfred Poor

With all the attention given to sub-6-pound projectors lately, it's hard for a larger model to make a splash in the media. But the new 9.7-pound Toshiba MediaStar TLP651 is worth a look, because this is a projector that can see for itself. Like other models in the MediaStar line, the TLP651 (\$7,995 list) has a built-in document camera that lets you project images of paper documents or even three-dimensional objects.

The TLP651 comes with an attractive padded carrying case that also has room for a notebook, cables, and other accessories. And there are some handy accessories. An infrared receiver can connect to a PS/2 mouse port, serial port, or USB port to let you control the computer using the projector's remote control; this feature was easy to use and is a definite asset.

The full-function remote also includes a laser pointer and signal source selection. About the only feature missing is a volume control; volume can be adjusted only through the on-screen menu system.

The color document camera stows snugly at the back of the case but can swing up to view objects from a wide range of angles. It has a manual focus and a separate light that can be turned on if needed. The projector has manual focus and zoom controls.

Three XGA-resolution,

High Performance) lamp combine to create images that Toshiba rates at 1,100 ANSI lumens. We measured 859 lumens using the PC Magazine Labs testing protocol—easily bright enough for normal room lighting—and this result is close to those of similarly rated projectors. The image had a decent uniformity index, 1.14, but the contrast ratio was a bit low at 81:1; the contrast score was hurt by a high black level that could not be reduced by adjusting the brightness.

Image quality was generally fine. Focus was sharp, and color ramps were smooth. Color tracking was good, with just a slight olive tint to midrange gray shades. We saw noticeable flicker and some pixel jitter that could not be completely eliminated using the phase controls, and we also observed some horizontal ghosting.

The TLP651 is significantly lighter than Toshiba's earlier MediaStar models, and it combines the functions of an overhead projector with a display for computer and video sources. This is a flexible projector that you can easily take on the road. **Toshiba MediaStar TLP651.** List price: \$7,995. Toshiba America Consumer Products Inc.,



THE BIG PICTURE: The TLP651's document camera, which folds away, lets you project documents and even 3-D objects.

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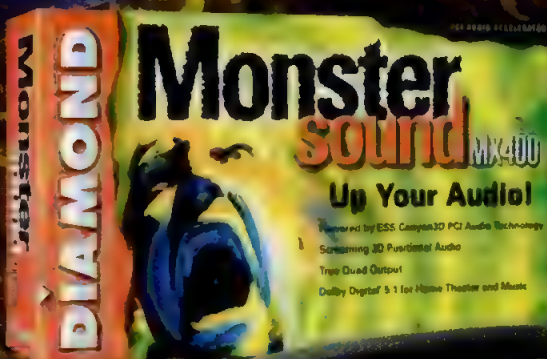
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Screenshot of Slave Zero courtesy of Accolade.

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Taming the Web

Giage WebSpace is a cross between your Web browser and Windows Explorer.

By Alan Cohen

On the Web, there really can be too much of a good thing. Browsers do a fine job of finding and displaying information, but then what? Organizing that data usually involves a decidedly low-tech approach—scraps of paper scattered on the desk or sticky notes stuck to the monitor. Giage, a new company, is betting that there's a better way—and that it's called WebSpace (a free download for a limited time, then \$99).

As a browser, WebSpace will disappoint. The basics are covered but not much more. WebSpace has no AutoComplete function, no customizable toolbar, and not even a full-screen mode.

Fortunately, WebSpace is

more than a browser. The software lets you select any page, link, text, or image (or an entire site) and drag it from the main browser view to the Organizer, a second, smaller window on the left side of your screen.

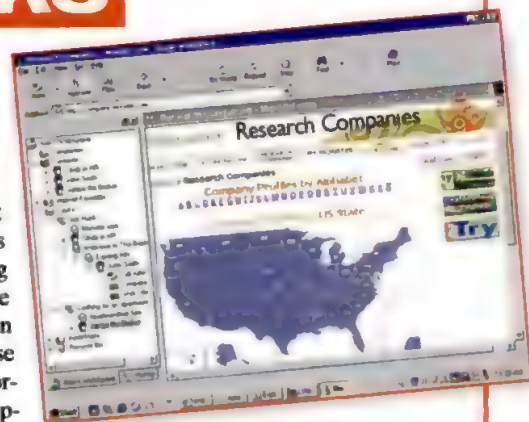
Within this window, you can organize items pulled from the Web, using a system of folders that looks very much like Microsoft Windows Explorer. You can also add notes, pull files off your hard disk, and store contacts and companies.

A rather spartan-looking program, WebSpace won't win any awards for its graphical design. But don't be deceived: This is useful stuff. WebSpace lets you save items quickly and organize later; just drag, drop, and move on. This is a less intrusive approach than competing program

iHarvest takes (it's a free download at www.iharvest.com).

Though sleeker-looking, iHarvest lacks WebSpace's simplicity. Moving stored items is more time-consuming in iHarvest, because you really need to organize as you capture. On the other hand, iHarvest works within Microsoft Internet Explorer 5, and its browser is much better than WebSpace's.

Another useful feature in WebSpace is called Virtuality. Since information can be used in different contexts, WebSpace lets an item exist in different locations within the Organizer. A contact, for example, may relate to two different projects and therefore may reside in two different folders. If the contact is edited in one place, it is changed everywhere.



BROWSE AND DROP: To store information from the Web, just drag and drop it onto a WebSpace folder on your hard disk.

WebSpace may not be pretty, but the program is a quick and simple way to capture, organize, and manage information—and save a lot of trees in the process. **Giage WebSpace.** Price: Free for an introductory period; then \$99 direct. Requires: 32MB RAM; 30MB hard disk space; Microsoft Windows 95, 98, or NT. Giage Ltd., Cincinnati; 513-562-8700; www.giage.com.

Internet Integrator

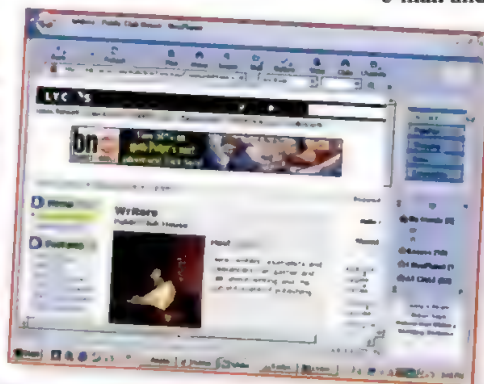
NeoPlanet 5.0 combines the most popular Internet functions into a single desktop application.

By Alan Cohen

An intriguing if not quite perfected free download, NeoPlanet 5.0, available at www.neoplanet.com, wants to be your go-to place for all your Web needs—browsing, e-mail, instant messaging, chat, and clubs. If that sounds suspiciously like a Web portal, well, that's what NeoPlanet has in mind.

But there's a difference: NeoPlanet integrates these functions in a single desktop application, so there's no need to load separate instant messaging and e-mail clients, and navigation is simplified. NeoPlanet does an admirable job of integrating its tools. Too bad, then, that some of those tools are lacking.

The program isn't likely to woo Internet veterans, who are



BEYOND BROWSING: NeoPlanet puts all your Internet activities under a single roof.

more likely to stick with their existing, more robust applications, but for beginners NeoPlanet has its charms. The screen is divided into windows: a browser, a buddy list, a channel bar, and news headlines. Toolbar buttons take you to clubs and

e-mail. The product has an intuitive interface, with some nice touches such as pop-up messages that alert you to new e-mail and "skins" that let you customize NeoPlanet's look.

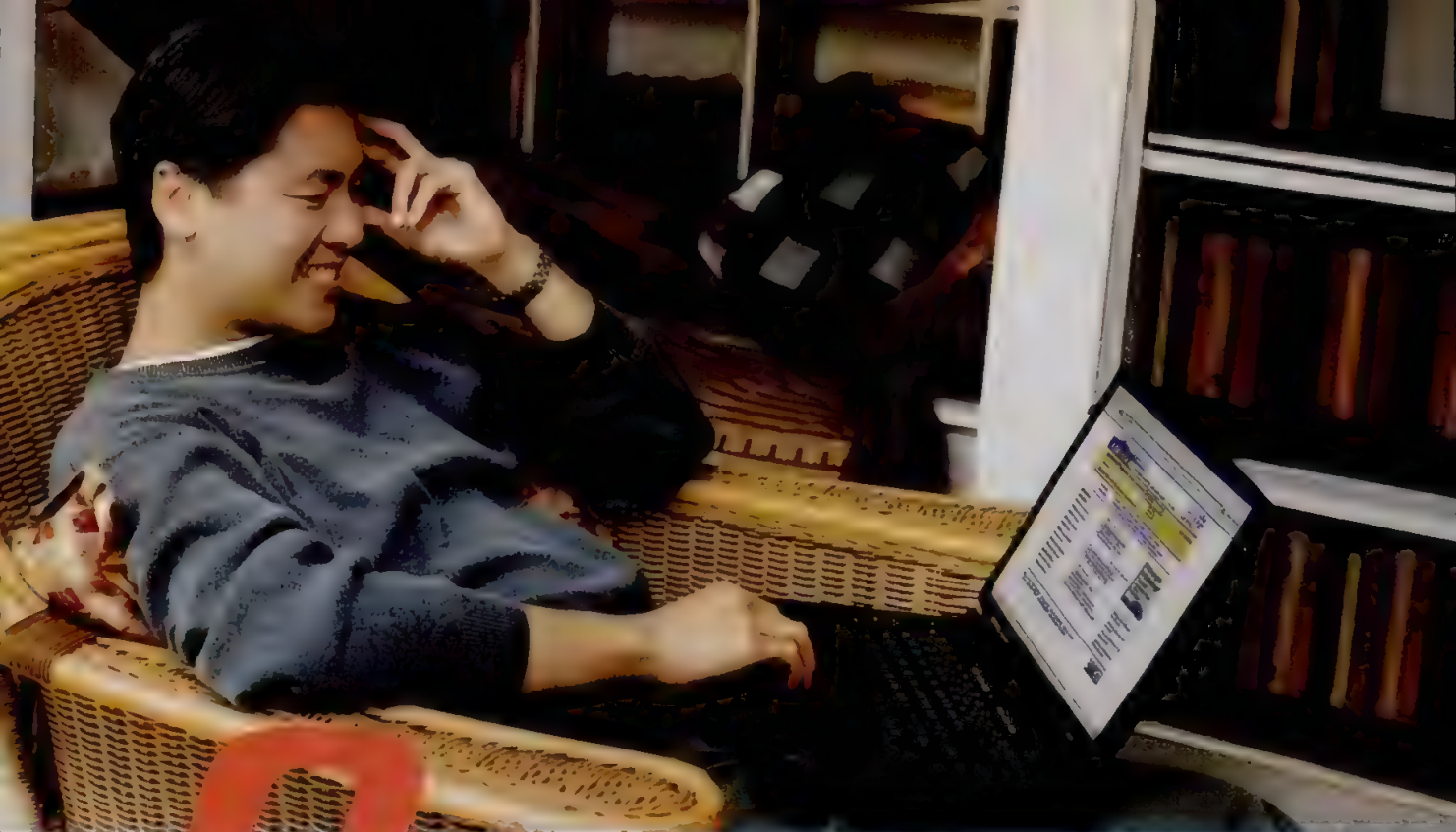
NeoPlanet's browser may not boast every bell and whistle (there's no AutoComplete function, for example), but it does go beyond the basics. One button displays a list of related sites (courtesy of Alexa); buddy lists and channel bars can be collapsed and expanded. E-mail is robust, complete with filters, distribution lists, and the ability to check mail from multiple accounts.

But decent e-mail and browsing are not exactly breaking news anymore. Unfortunately, NeoPlanet's instant messaging is no match for programs such

as ICQ or Yahoo! Pager. The interface is clunky, and you can't send files or stylized text. A bigger problem is that you can only IM with other NeoPlanet users. Unlike in MSN Messenger, there's no interoperability with the millions of AOL users. NeoPlanet partners with Lycos for content and communities, but Lycos is no Yahoo!—and it shows, with less active community areas and less extensive news coverage. Noticeably absent from NeoPlanet's tool bag is a calendar, the latest must-have application to hit the Web.

NeoPlanet is promising, but the product has to do more and do it better to win over the Web-savvy.

NeoPlanet 5.0. Price: Free download. Requires: 3MB hard disk space; Microsoft Windows 98, Microsoft Internet Explorer 3.02 or later with Microsoft Windows 95 or NT. NeoPlanet Inc., Phoenix; 602-426-2800; www.neoplanet.com.



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Easy Photo Editing

Three new photo-editing applications provide added versatility, ease of use, and Web functionality.

By Sally Wiener Grotta and Daniel Grotta

Digital photography finally appears to be gaining momentum. Anticipating this phenomenon, software companies have had years to perfect their entry-level photo-editing packages, and their efforts are apparent in this year's crop of image-editing programs. For this story, we took a look at the new versions of three popular photo-editing programs: MGI PhotoSuite III Platinum Edition, Microsoft Picture It! 2000, and Photo Express Platinum 2000. Adobe PhotoDeluxe 4.0 was not available in time for this story.

Each of the three programs has become more versatile and even easier to use. All emphasize increased Web functionality and have added fun and attractive templates, art, and special effects. As your interests change, each program offers additional downloadable projects, filters, and photos.

These programs follow the now-established standard for entry-level photo editing, which splits the interface into activities—steps typical users take when working with photos in a computer. You'll find varied windows or groups of commands for getting a photo from your files, a camera, a scanner, an online service, and so on; editing it; putting it into another form (such as a collage or postcard); and out-putting it (via print, the Web, and e-mail). One of the major differences among the programs was in how easy it was to move between activities without hitting interface roadblocks.

Of the three, Microsoft Picture It! 2000 is best for novices. The program provides guidance at every step, it is easy to switch between editing images and creating projects, the templates are

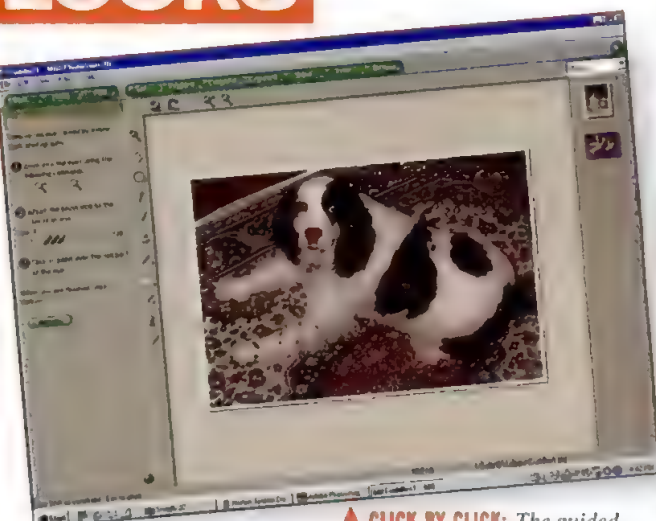
attractive and editable, and the Web output is engaging.

MGI PhotoSuite III Platinum Edition

In its latest version, MGI has toned down the program interface to appeal to a broader audience. The result is a simpler application most notable for its Internet integration and direct camera access. However, MGI PhotoSuite III Platinum Edition (\$50 street) retains some quirks that still make it more difficult to use than competitors.

MGI has improved PhotoSuite's ease of use, though it's not always obvious, by employing guided tool panels throughout the program. You'll need to experiment and try clicking on buttons to see what they'll do.

PhotoSuite's quality projects are a pleasure to use. Adding or editing text and props is quite direct. Manipulating objects in-



▲ CLICK BY CLICK: The guided tool panels have improved PhotoSuite's ease of use and accessibility.

volves drag-and-drop sorting in the Object Manager (you need to know to open up that part of the interface).

The Prepare mode offers an appropriate balance between automated editing and options. The toolbar is always accessible and well-suited for advanced users who don't need guides. New activities include fully integrated programs for panorama stitching and PhotoTapestry, which creates a patchwork quilt effect. When painting, you now have better control, because the

cursor displays as the brush tip size. But you still can't clone from one picture to another.

Selecting a portion of your picture is easier, because the Edge Finder selection tool can be edited. But we had our greatest difficulty with PhotoSuite in selecting: The selection tools exist only in Prepare mode, but collaging (combining photos together) is a Compose mode activity. To use a selection in your collage, you must copy it to the clipboard, change modes, then paste it into your composition, which is cumbersome.

PhotoSuite's strongest suit is its Web Browser design. Click on the Browse button and you'll be connected to PhotoSuite's home page for new content and other photo-related links. E-mailed photos and slide shows are now in universal formats (EXE and JPEG).

MGI PhotoSuite III Platinum Edition is a powerful program based on impressive technology. But although its ease of use has been improved considerably, it doesn't go far enough for the novice user—nor does the program provide all the control that a prosumer would want.

MGI PhotoSuite III Platinum Edition. Street price: \$50. MGI Software Corp., 888-644-7638; www.mgisoft.com.

Adobe Gets ProActive

If all you want to do with your photos is to get them organized on your computer, correct a couple of basic problems, and share them with your family and friends, then you should consider Adobe ActiveShare—a free downloadable program from Adobe Systems.

ActiveShare is a basic photo editor that brings pictures in from your digital camera, scanner, CD, or other drive. Editing is limited to four tasks: Instant Fix for brightness and contrast, Rotate, Trim (crop), and Red Eye. The only Photo Projects are Slide Show, Wallpaper, and Add Motion. Unfortunately, a Slide Show can't be saved. Instead, it must be viewed only on your own computer when it is created, within the ActiveShare interface.

Simple icon clicks send selected photos via e-mail or to your printer. You can just as easily upload the photos to a private, password-protected online photo album at ActiveShare.com.

Adobe ActiveShare has many limitations, but considering that both the software and the online service are free, you might just be able to overlook these.

Adobe ActiveShare. Price: Free download. Adobe Systems Inc., San Jose, CA; 800-492-3623; www.activeshare.com.

Microsoft Picture It! 2000

Microsoft Picture It! 2000 (\$54.95 list, with a \$20 mail-in rebate) is a deceptively simple program to use. Yet underlying the unambiguous interface are nearly all the tools and features most users could want or need.

Unlike the other programs we looked at, Picture It! is divided into only two tabbed activity areas: Workbench and Projects. And the workflow between them is seamless. All open pictures are displayed in the Filmstrip below the workspace. The drag-and-drop stack of objects is found to the right, and the panel with nested commands and step-by-step guidance is on the left.

One important innovation is the new Mini Lab, which is the easiest process we've seen for getting pictures into a computer and ready for use. Using large thumbnails, you can select specific pictures for batch processing of the most common tasks (such as rotate, crop, and auto brightness/contrast). Then you can select others to be handled differently. This is effortless and timesaving; unfortunately, there isn't a similarly easy batch save on the other end of the process.

Other improvements also increase convenience and efficiency. For instance, the new Find command locates pictures anywhere on your system or network by any related word. Now that multiple objects can be selected, easy-to-use graphical align and distribute commands can be used. And tool options (such as brush styles) are easier to view all at once.

Editing, painting, collaging, and managing projects are all well directed but at the same time let you take creative control. The clone tool is still limited to working within only one picture. But we had no difficulty combining selections from multiple images or editing templates.

The program has some fun new Web projects, including sound recording, flip-book animations, and more. For instance, you can create special-effect GIF animations of your own pictures.

Microsoft Picture It! 2000 is the quintessential entry-level photo editor, providing guidance at every step while letting you explore the creative possibilities of its rich feature set.

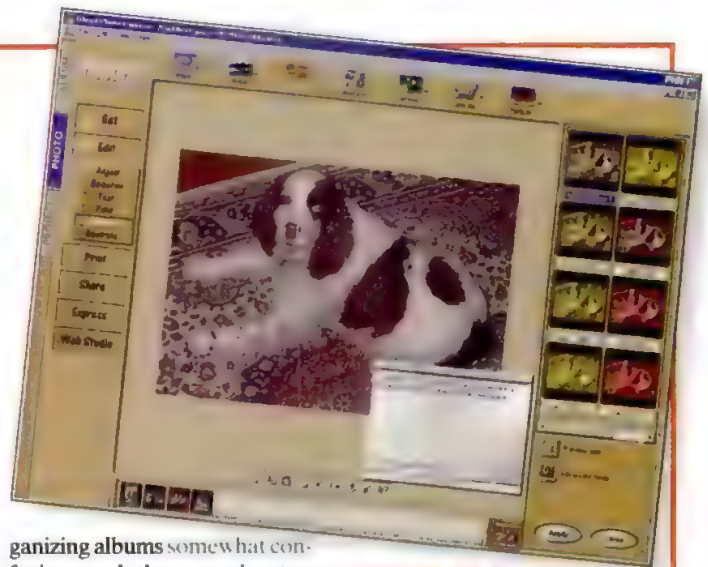
Microsoft Picture It! 2000. List price: \$54.95, with a \$20 mail-in rebate. Microsoft Corp., 800-426-9400; www.microsoft.com.

Photo Express Platinum 2000

This newest version of Photo Express (\$50 street, upgrade \$30) tries to break the mold. On start-up, it doesn't look anything like other photo-editing programs. But though the new version has added pop-up Guide Tips, users are still left pretty much on their own.

Photo Express's interface is divided into three tabbed views: Album, Photo, and Projects. An item called Filmstrip that shows currently open images is displayed at the bottom, and a panel to the right of the workspace displays options for the current activity.

In Album, you can organize AVI, MIDI, MOV, MPG, and WAV media files, as well as images. But we found using and or-



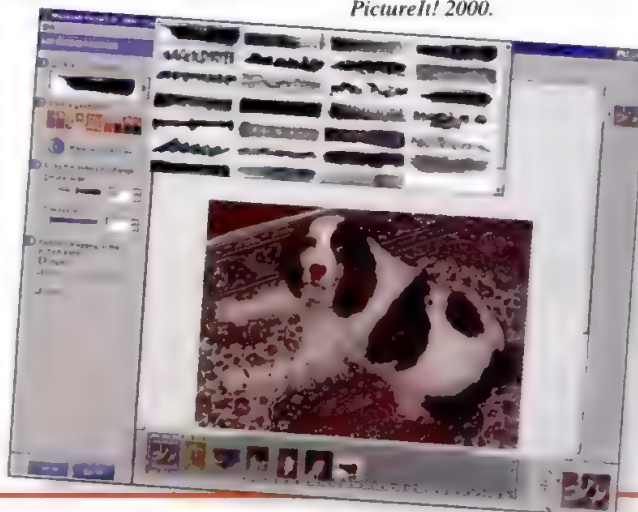
ganizing albums somewhat confusing, and they require too many mouse clicks.

Basic image editing is implemented well. The new Auto Enhance tools provide one-button corrections of focus, exposure, and other common tasks. But other tasks, such as collaging and template projects, are more difficult than they need to be.

For instance, the new Smart-Select tool is an edge-detection selector that works well. But you can't edit the defining points other than adding to or subtracting from the selection. And Photo Express does not let you select or erase portions of a floating object. Therefore, any picture you add to another will always be a rectangle.

When working with templates, you cannot simply drag and drop a photo from Filmstrip into the placeholders. Instead,

▼ **BRUSHING UP:** Tool options such as brush styles are easier to view in Microsoft Picture It! 2000.



▲ **NOW YOU SEE IT:** In Photo Express's Photo view, the options for the current tool or effect are displayed in the right-hand panel.

you must click on the placeholder and then on a small icon attached to it, from whose pop-up list you select the source of your image (file, scanner, and so on).

The new Web Studio extends Photo Express's Internet functionality. Here you can make photo albums, slide shows, and multimedia greeting cards that can be sent via e-mail as an attached EXE file. In addition, one click connects you to Ulead's fun Gift Services Web site, where you can upload pictures and select from scores of picture-based gifts such as mugs and T-shirts.

In the Platinum 2000 version, Photo Express includes Cool 360 (a wizard-based panorama-stitching program that exports with a viewer) and Photo Assistant (an Office plug-in for direct acquiring and simple editing of images within Word). A stand-alone version of Photo Express 3.0 is available for \$25 (street).

Beneath Photo Express Platinum 2000's kludgy interface is some powerful code. The program is optimized for Pentium III and offers support for ICM 2.0 color management, as well as for 12-bit gray-scale and 36- or 48-bit color images. But Ulead misses the mark on novice-level photo editing.

Photo Express Platinum 2000. Street price: \$50; upgrade \$30. Ulead Systems, 800-858-5323; www.ulead.com.

WEB GEEK

ARTISTE





Adobe GoLive



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Celeron Speeds Up

New notebook PCs offer better performance as Celeron steps out of the Pentium chip's shadow.

By John Morris

Recently, Intel announced that it was boosting its mobile Celeron processor to 466 MHz. This is good news for notebook buyers, because you can now get a high-performance notebook PC at a value price.

Although the two new notebooks reviewed here share the same fast Celeron processor, they are two very different beasts. The Dell Inspiron 7500 C466VT is the definition of

measures 2.3 by 12.8 by 10.8 inches (HWD). Why put up with all this weight and size in a notebook PC? In a word: power.

The system we tested (\$3,699 direct) included 128MB SDRAM (upgradable to 512MB) and a 25GB hard disk. The Inspiron also has two new, modular bays housing the lithium ion battery and a combination DVD-ROM/floppy disk drive. But both can also hold 25GB hard disks, so you can have as much as 75GB of storage at your disposal when working off AC power. The bays can also accommodate additional batteries or removable media (CD-ROM, LS-120, and Zip drives).

Driven by an ATI Rage Mobility-P video controller with AGP 2X, the Inspiron can display video resolutions up to SXGA (1,400-by-1,050).

A TV-out port lets you connect the system directly to a television.

Multimedia features are rounded out by 3-D positional audio and audio ports. The Inspiron has all the necessary ports, including a USB connector, an integrated 56K modem, and two Type II PC Card slots.

With specs like these, the Inspiron was predictably a peak performer. And its BatteryMark score was an impressive 4 hours 16 minutes.

Add in Microsoft Office Small Business Edition and Dell's standard three-year warranty and spotless service record and the Inspiron truly lives up to

the term *desktop replacement* by sacrificing nothing.

Dell Inspiron 7500 C466VT. Direct price: \$3,699. Dell Computer Corp., Round Rock, TX; 800-388-8542; www.dell.com.

IBM ThinkPad i Series 1480

Introduced in the beginning of this year, the IBM ThinkPad i Series is designed to appeal to consumers by combining ThinkPad innovation with ease-of-use features and attractive prices. The first redesign of the series, the IBM ThinkPad i Series 1480 furthers that goal.

Although the i Series 1480 retains the same beveled base, the 14-inch TFT display can be embellished (in a tip of the hat to the Apple iMac) with optional color covers (\$30 street each). In addition to the full-size keyboard (with the new ThinkLight keyboard light) and ample wrist rest, the i Series 1480 has four colored Easy Launch Buttons. By default, these buttons take you to an Internet guide, a search engine, an online shopping center, and e-mail from partner Lycos, but you can program them using the applet in the Windows Control Panel.

Don't let these touches fool you into thinking the i Series 1480 is a toy. Our system (\$2,500 street) included 64MB RAM, a 6.4GB hard disk, a 4X DVD-ROM drive, a floppy disk drive, and a lithium ion battery. All this fits into a system that is only 1.6 inches thick and weighs 7.3 pounds (8 pounds with the AC adapter).

THE BIG BOX:

This Inspiron isn't for frequent fliers, but it is a fast, full-featured desktop replacement.

desktop replacement, delivering top-notch performance, while the IBM ThinkPad i Series 1480 is a value notebook offering a great deal for the money.

Dell Inspiron 7500 C466VT

The portable PC for those who never plan to take it anywhere—or at most rarely—the Dell Inspiron 7500 C466VT weighs in at 9.4 pounds, or more than 10 pounds with the AC adapter. With the 15-inch TFT display spilling over the edge of the Inspiron's base, the system



BEYOND BLACK:

Following an industry trend, the IBM ThinkPad i Series 1480 can be dressed up with color covers.

Despite its price, the i Series 1480 is an excellent multimedia system, with an Instant Audio feature that lets you play CDs or DVDs when the system is off. The AV controls and LED read-out on the front edge let you control the drive with the case closed, so you connect it to a television (with the included S-Video port) and use it as a set-top DVD drive. In case you are on the road, the integrated Altec Lansing SoundGuide speakers produce surprisingly good sound. All the expected ports are present, including a USB connector.

Based on our benchmark tests, the i Series 1480 isn't going to set any speed records and certainly can't match desktop replacement-class notebooks such as the Inspiron. Nevertheless, the unit performs on a par with many top-of-the-line Pentium II-based systems. Its BatteryMark score was a solid 3 hours 43 minutes.

The i Series 1480's software bundle includes Quicken 99 and Lotus SmartSuite Millennium Edition. IBM offers a one-year warranty. Simply put, the IBM ThinkPad i Series 1480 is a great bargain for those who want a value notebook without making many compromises.

IBM ThinkPad i Series 1480. Street price: \$2,500. IBM Personal Systems Group, Somers, NY; 800-772-2227; www.ibm.com/pc/us/thinkpad/series.

BENCHMARK TESTS

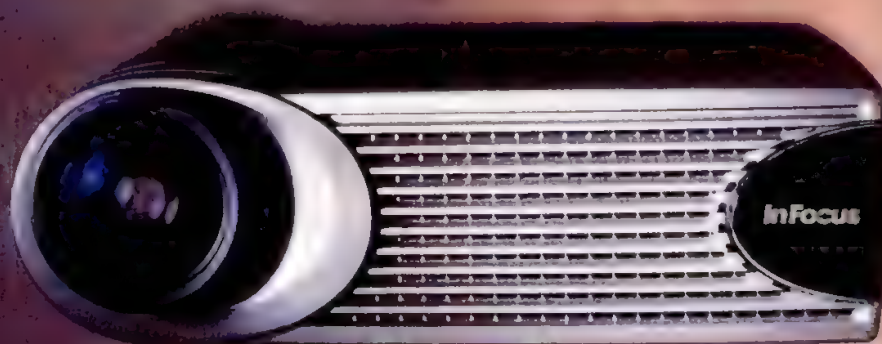


High scores are best.

	ZD Business Winstone 99	ZD Business Graphics WinMark 99	ZD Business Disk WinMark 99 (thousands of bytes/sec)	ZD Battery- Mark 3.0 (hours minutes)
Dell Inspiron 7500 C466VT	20.2	134.0	3,025	4:16
IBM ThinkPad i Series 1480	15.0	94.6	1,715	3:43

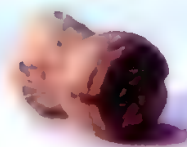
SUBSTANCE: 4.8 Pounds.

STYLE: Tons.



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PhotoDraw Gets Web Savvy

Microsoft's business graphics program gets new Web graphics tools.

By Edward Mendelson

Already the most efficient and intuitive graphics editor for small business and personal use, Microsoft PhotoDraw 2000 has turned into a powerful machine for producing Web animations, rollover buttons, and other visual effects. Version 2 of this member of the Microsoft Office 2000 family (\$90 street, after a \$20 rebate) preserves the lucid interface and wizard-based ease of use of the first version and adds a high level of integration with other Office 2000 applications (though Office doesn't have to be installed).

Webmasters lacking professional design skills will love PhotoDraw's ability to create animated banners with effects such as text that grows to fill a picture

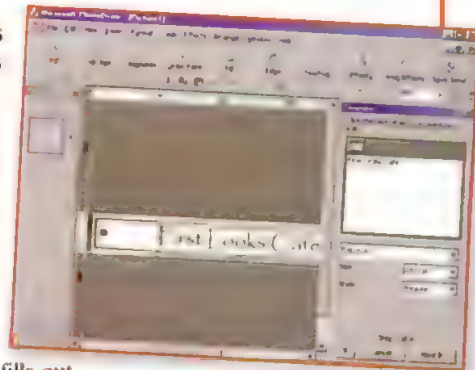
frame. When you save the animation, PhotoDraw prompts you to choose animation speed and other parameters for best performance. A gallery of prebuilt rollover effects creates multiple versions of a single image and saves them transparently on a Web page.

PhotoDraw combines bitmap painting and photo tools and line-drawing (vector) tools in the same interface, so both types of tool can be used when creating an image. "Smart shape" vector images include handles for easy resizing and reshaping. You don't need to know which image formats should be used in Web pages or printed output, because a "Save for use in..." wizard walks you through the process of outputting a file.

A CD filled with professional-

ly designed templates can be used as the basis for your own letterheads, banners, and Web graphics, but these designs tend to be overly soft and fuzzy and lack the impact of the graphics supplied with Microsoft Publisher. A new convenience feature lets you apply multiple effects, such as fills, outlines, and edges, and save them as a style for use with other images.

Professional designers may shy away from PhotoDraw because it doesn't let them modify existing effects, and the program's target audience may get confused by features like "designer edges" that work properly only if you remember to press a "Stretch to fit" button. But PhotoDraw 2000 far surpasses the competition in power and efficiency, and the program is the first choice for nonprofessionals who want dazzling



IMAGING BY NUMBERS: Wizards take you through each step in the process of creating an image from a template.

graphics for their printed pages, Web sites, and presentations. **Microsoft PhotoDraw 2000, Version 2.** Street price: \$90 (after \$20 rebate). Requires: For Microsoft Windows 95 or 98, 16MB RAM; for NT 4.0, 32MB RAM; 190MB hard disk space (115MB if Office 2000 is installed). Microsoft Corp., 800-426-9400; www.microsoft.com/office/photodraw.

Put It in Print

Corel Print Office 2000 enhances an already strong desktop publishing suite.

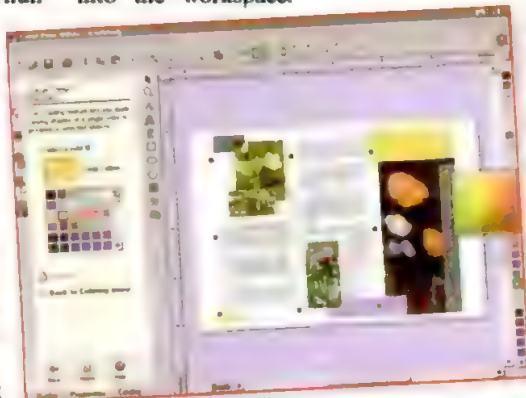
By Luisa Simone

If you're hunting for a low-cost, entry-level desktop publishing suite, you'll have a hard time beating this deal. For \$99 (list), Corel Print Office 2000 gives you four applications; thousands of templates, clip-art images, and photos; and hundreds of fonts, backdrops, and borders.

The core program, Corel Print Office 5, provides basic page-layout tools wrapped in an easy-to-use interface. A split screen provides room for Notebook, a separate window containing step-by-step instructions to create, modify, and print a wide range of publications.

If you're already using Print Office, you won't find much in the way of new features

in this release. One new tool—Shading—lets you change the color but maintain all of the tonal values in imported vector clip art. The interface has also been tweaked: You can now drag and drop clip art, photos, and templates from Notebook directly into the workspace.



ALL BUSINESS: Small-business users will appreciate the new, professional-looking templates.

More useful is the new IXL integration, which lets you use Notebook to preview and import images from a digital camera. The new templates, which strike a more professional design note, are also a plus.

Corel Print Office delivers robust design and drawing tools, including true bezier-curve editing. But compared with its chief competitors (Microsoft Publisher 2000 and I Publish), Print Office lacks several advanced features and automated design help. As one example, though you can save font attributes as a preset, you still have no way to save paragraph-level formatting.

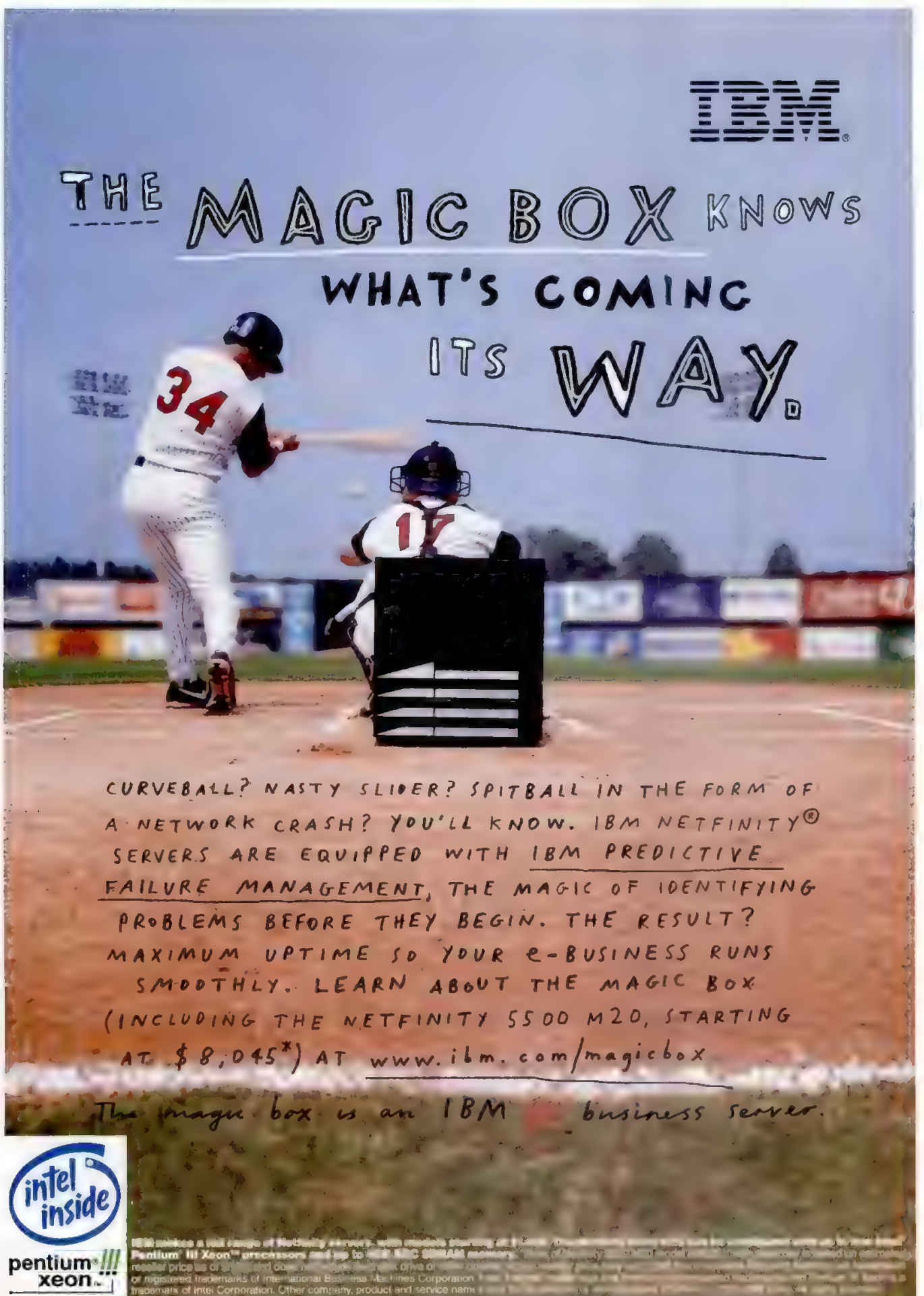
Much of the real value in Corel Print Office 2000 lies in the bundled programs. For

instance, Corel Photo House 5 now supports multilayered images, so you can rearrange a composition (and even edit text) without degrading image quality. And Photo House offers a new preview for Web output.

The suite's standard organizer, Colleagues and Contacts, has been replaced with Corel Central 9—the same robust address book and scheduler that ships with WordPerfect. And for those who are not satisfied with the HTML output from Print Office, the suite now includes an enhanced Corel Web Designer 2.

Corel does not plan to offer a special upgrade price. So while new users may see this bundle as a bargain, existing users may not be able to justify spending the full purchase price for a handful of new features.

Corel Print Office 2000. List price: \$99. Requires: 16MB RAM; Microsoft Windows 95, 98, or NT. Corel Corp., Ottawa; 800-772-6735; www.corel.com.



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Message Manager

Symantec's TalkWorks PRO 3.0 can make your small company sound like a big business.

By Greg Alwang

If you want your small office or home office to convey a more professional image, Symantec's TalkWorks PRO 3.0 (\$129.95 list) can manage your answering system, including both voice mail and faxing duties. TalkWorks PRO supports many high-end answering system features such as Caller ID, call forwarding, fax-on-demand, remote message retrieval, Find Me notification, and call logging. With a revamped interface and a new setup wizard, TalkWorks PRO lets even the smallest of businesses easily set up a sophisticated answering system.

TalkWorks PRO requires at least a Pentium/166 with a sound card and a voice-capable modem or ISDN device. The Setup Wizard guides you through configuring the answering system, selecting default or custom greetings, and creating up to 899 mailboxes for storing voice messages or faxes. The new interface simulates a telephone and answering machine setup, letting you quickly access messages and voice and fax options.

With Caller ID, TalkWorks PRO lets you identify particular callers who will hear custom greetings before being forwarded to specific mailboxes. The Screen Pop feature uses Caller ID to search your phone book for incoming numbers and pops up caller information. Address books can be imported, or you can link directly to Symantec's ACT!, Microsoft Outlook, or various ODBC (Open Database Connectivity) formats.

A new Message Sharing feature lets you set up your TalkWorks PC as a host and share the modem and message management features among a workgroup of users. Integrated

within TalkWorks PRO is WinFax PRO 9.0, which provides shared faxing and fax-on-demand capabilities.

TalkWorks PRO's unified messaging features can forward live calls to another number, page you when you get new messages, or forward voice messages to your e-mail account as WAV file attachments. A Find Me feature tries up to three phone numbers to notify you of new faxes or messages.

If you use one phone line for voice, fax, and data connections, TalkWorks PRO can discrimi-

nate between different types of calls, so you can share a line to retrieve messages remotely as well as remotely control your PC using a program like pcAnywhere. The Message Manager lets you track incoming and outgoing messages and faxes. Reports detail incoming, outgoing, and fax-on-demand calls, and even hang-ups.

TalkWorks PRO 3.0 is an effective tool for managing the flow of information in and out of your small office or home office and, at the same time, giving it a professional appearance. **TalkWorks PRO 3.0.** List price: \$129.95. Requires: 32MB RAM;



VIRTUAL PHONE: TalkWorks' telephone and answering machine interface lets you manage messages, speed-dial, or send faxes.

100MB disk space; Microsoft Windows 95, 98, or NT 4.0; compatible voice-capable modem. Symantec Corp., Cupertino, CA; 800-441-7234; www.symantec.com.

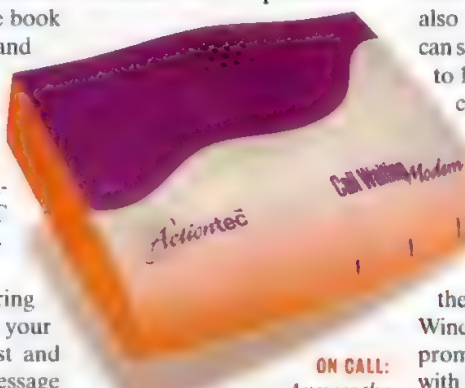
Never Miss a Call

With the Actiontec 56K USB Call Waiting Modem, you can stay online while staying in touch.

By Steve Rigney

As more home users connect to the Internet, the Call Waiting feature found on most telephones becomes a nuisance. You must pre-dial *70 or some such code when connecting to your ISP or risk losing your connection if someone calls you on that line. Another, more expensive solution is to have two phone lines.

The engineers at Actiontec didn't like either solution, so they created the Call Waiting Modem line of products.



ON CALL: Answer the phone and stay online with this Actiontec modem.

Their newest model is the Actiontec 56K USB Call Waiting Modem (\$130 street), which allows you to answer the telephone via Call Waiting and remain online. (Actiontec is offering a \$50 limited-time rebate if you sign up for EarthLink service for three months at \$19.95 per month.)

You only have approximately 7 seconds to talk to the caller before you are disconnected from the Internet, but the feature is still useful. In addition to V.90 56K support, the USB modem is also a Group 3 fax device and can send and receive faxes at up to 14.4 Kbps. The package includes Cheyenne's BitWare fax software, or you can use the fax drivers built into Windows 95 or 98. Fortunately, installation on Windows 98 is a snap. After you connect the modem to your USB port, Windows detects the device and prompts you to input the CD with the specific drivers.

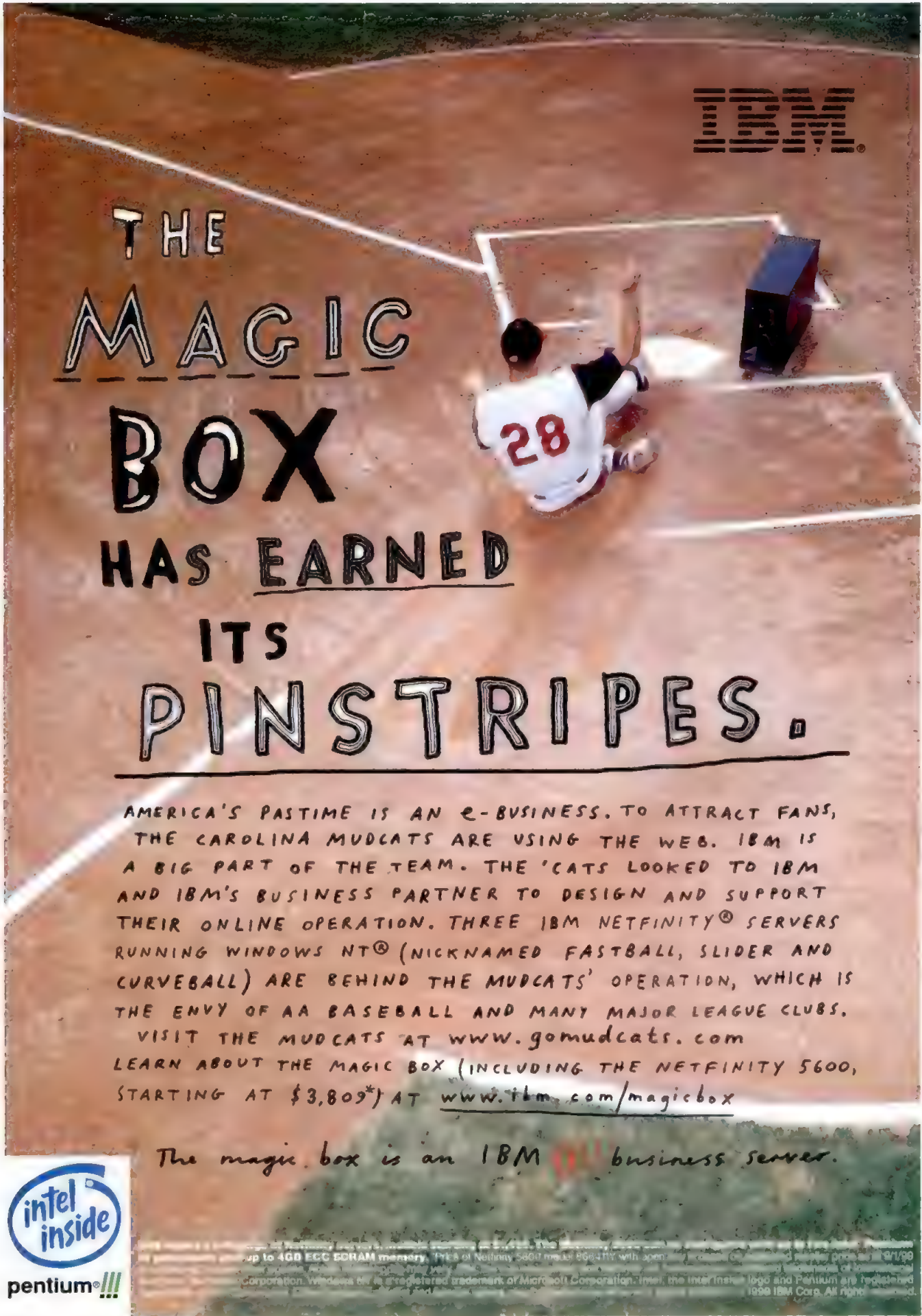
The driver lets you configure the Call Waiting feature in sev-

eral ways. You can enable the feature, which means the modem will ring for up to five times when an incoming call comes in before it hangs up, preserving your connection. You can configure the feature to disconnect your online connection when another call comes in. Finally, you can disable the Call Waiting feature, the same as typing *70 before a call.

The modem's Call Waiting feature is convenient, but we found it to be slightly lacking. The time you have depends on the type of modem your ISP is using. On our tests, we had only about 4 seconds before we were disconnected.

If you spend a lot of time online, have only one phone line, and constantly miss calls, the Actiontec 56K USB Call Waiting Modem is a good solution. Having 7 seconds to talk is not a long time, but you won't miss an important call or interrupt a large file download when someone calls.

Actiontec 56K USB Call Waiting Modem. Street price: \$130. Requires: Windows 95 OSR2, 98, or MacOS 8.6. Actiontec Electronics Inc., Sunnyvale, CA; 800-797-7001; www.callwaitingmodem.com.



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Network in a Box

The Cisco 1750 modular access router provides data, voice, and more in one unit.

By Steve Rigney

In an effort to squeeze multiple network services into a single box, Cisco has developed the Cisco 1750 modular access router. The 1750 is fairly inexpensive, works with several WAN connections, and is easy to install. But the real appeal is that you can add Voice over IP (VoIP) data, a firewall, VPN, and other modules to the router without having to purchase, install, and maintain more stand-alone boxes.

The 1750 series consists of three models. The 1750 base unit (\$1,495 list) is housed in a small chassis with three option slots, a console port for management, and a built-in 10/100-Mbps Ethernet connection. The 1750-2V (\$2,295 list) adds software and memory for up to two voice in-

terfaces, and the 1750-4V (\$2,695 list) can handle four VoIP data connections. The optional WAN and voice cards range in price from \$400 to \$1,000.

The unit we tested (\$4,095 list) included four voice connections and a T1 WAN adapter complete with built-in CSU/DSU. You can also purchase ISDN, serial, and fractional T1 WAN adapter cards.

We were pleasantly surprised with the installation. We used the Cisco ConfigMaker Tool, which offers a graphical interface as opposed to the command-line instructions formerly needed to set up the internal Internet Operating System (IOS).

The most exciting new feature of the 1750 routers is Voice over IP. It's accomplished by using a



SMALL PACKAGE:

The Cisco 1750 is about the size and shape of a Bose Wave radio.

voice interface card as well as gateway software running on the IOS. Each card provides two voice ports that you can attach to any analog phone, a PBX, a key system, or a fax machine.

The administrator can configure these ports for specific outbound calls between branch offices or to a corporate site. The voice cards support H.323 (an ITU standard for videoconfer-

encing) and provide the toll-quality features you need to establish a clear call across the data network.

For enhanced security, you can purchase the IOS Firewall upgrade (\$900 list) for the 1750. The 1750 can also handle a VPN update via the IP Security feature set (\$400 list). Like the firewall, the IPSec update lets you create a VPN for office-to-office and remote-access connections.

The reasonably priced Cisco 1750 routers will appeal especially to small and branch offices seeking to avoid the costs of buying and maintaining multiple network devices.

Cisco 1750. List price as tested: \$4,095. Cisco Systems Inc., San Jose, CA; 800-553-6387; www.cisco.com.

A Real Small-Network Deal

Novell Small Business Suite 5 is an all-inclusive package for low-cost, simple networking.

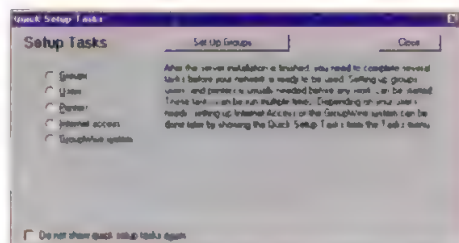
By Les Freed

Priced at \$1,295 (list) for five users, Novell Small Business Suite 5 (SBS) delivers all the software you need to network a small office—and then some. SBS includes a network OS (NetWare 5), a groupware package (GroupWise), an Internet proxy server (Border Manager), and more. According to Novell, the component parts of SBS would run nearly \$7,000 if purchased separately.

Even with all that value in the box, Novell has taken a few extra steps so that companies can deploy SBS with minimal effort. A new NetWare installer—developed especially for SBS—uses PowerQuest's DriveImage technology to copy a preconfigured NetWare 5 system to the server's hard disk,

saving at least 30 to 40 minutes of installation time. Once you've installed the server software, a new Windows-based Quick Setup program helps you set up users, groups, printers, Internet access, and GroupWise. We were able to install the server, create five users and groups, create a printer queue, and install GroupWise in about an hour.

A new management tool—



INSTANT NETWORK: The new Quick Setup program helps you set up users, groups, printers, Internet access, and GroupWise.

the Novell Easy Administration Tool (NEAT)—is ideal for those small companies without full-time IS staffs. NEAT hides much of the complexity of Novell's NDS directory system from the users and the system administrator, making it much easier to learn and use than the standard NetWare administration tool. NEAT provides all the functionality that most part-time system managers need.

No small business is complete without Internet connectivity, and SBS provides several connection tools and options. The new Novell Internet Connection Expert (NICE) automates the process of setting up an ISP connection via a server-installed analog modem, ISDN, or a DSL modem. SBS includes Novell's BorderManager

proxy server and firewall, and the GroupWise groupware system (see our review on page 169), which provides excellent Internet e-mail connectivity, including POP3, IMAP4, and browser-based e-mail access.

In addition to Novell's own bundle of products, SBS comes with a useful array of network application software, including a network database (Oracle 8), a network fax program (Tobit FaxWare) and a network antivirus package (Network Associates' VirusScan). Each package is provided on a separate CD with a customized installer program, so you can easily start with just the basics and add new features as your needs change.

All told, Novell Small Business Suite 5 may be the networking-software bargain of the year.

Novell Small Business Suite 5. List price: For 5 users, \$1,295; upgrade from Version 4.2, \$495. Novell Inc., Provo, UT; 800-638-9273; www.novell.com.



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Athlon vs. Pentium: Round 2

By Laura Cox, Nick Stam, and Carol Venezia

In the course of our online Talkback discussions with our readers concerning our AMD Athlon and Intel Pentium III system reviews, we promised that we'd update our test results and run GameGauge 2.0 at 640-by-480 resolution, with 16-bit color, to complement our already published 3D GameGauge test results at 1,024-by-768, also at 16-bit color.

Although a user who has a state-of-the-art graphics board with 16MB or 32MB of frame-buffer memory is likely to run games at 1,024-by-768 if the game is capable of doing so (1,024-by-768, 16-bit is the GameGauge default), readers are correct that 640-by-480 testing will

reduce fill-rate bottlenecks and shift the performance emphasis away from the graphics adapter and back to the CPU.

For this set of retests (you can see the results at www.zdnet.com/pcmag/stories/firstlooks/0,6763,2327279,00.html), we also chose to run additional 3D Winbench tests at 640-by-480, with 16-bit color, using front-buffer mode to remove vertical retrace limits and not utilize buffer flips. This is a nonstandard test mode, but it does allow us to focus more on the CPU. You can also see our September 21 story "Processors: The Right Speed for You" for comparison testing of Athlon chips and Pentium III chips running 3D Winbench 99 Transform and Lighting tests, which use a null driver and thus



no screen display. Also look at our FPUMark results in that story, which highlight floating-point differences between the chips and can also be applicable to future CPU performance on upcoming games.

Pay close attention to footnotes in the performance test charts, and also note that some games that were not fill-rate-limited at 1,024-by-768 did

REMATCH: Responding to feedback, we retested Athlon systems.

not show large differences tested at 640-by-480, but others that were, such as Powerslide, Quake II Crusher, and Unreal, showed large differences. In general, the Athlon performed better at 640-by-480, matching our results on our recent processor story's 3D Winbench Transform and Lighting and FPUMark tests.

Living with Linux

By Neil Randall

The Linux revolution shows no real signs of slowing down, as Release 2.4 of the operating system is on the way, with support for Universal Serial Bus (USB) devices and increased support for multiple processors, among other features. Linux is now pre-

installed on desktop and server systems offered by dozens of hardware vendors.

Microsoft views Linux as a legitimate competitor of Windows, as Linux users are now estimated at about 10 million. Linux packager Red Hat had a highly successful IPO recently on the stock market. And the

new GUI overlays for Linux—primarily Gnome (the default GUI for the popular Red Hat Linux package)—are showing users that Linux can work as a substitute for Windows. Linux's star is clearly rising.

One of the most exciting things about diving into the Linux market is that nothing has been settled yet; this is also the reason that the business community remains wary. A similar excitement arose when Microsoft released Windows 3.0: Suddenly, users had a whole new way of looking at software applications (unless they were already Mac users). But more important, there were many new packages to get excited about. Microsoft had yet to dominate the office applications area, for example.

In a similar way, this is where Linux is right now. Microsoft has the office suite market virtually locked up, but the vendor has yet to port any of its applications to Linux. Working with Linux means dealing with something new and different. For instance, Sun Microsystems announced plans in August to make its suite

StarOffice, the most popular Linux package, available for free.

But does this mean that Linux is heading for dominance over Microsoft? No, at least not any time soon. Microsoft knows how to compete and has shown a willingness to change its entire strategy to do so: Look at the speed with which the company switched to an Internet focus. Also, Microsoft's installed base is huge, especially in the personal desktop category but increasingly in business as well.

Despite all the advances in Linux technology, the software is still far too hard—and too intimidating—for many users to install. But with the strong growth of Linux's software base (and the quality of that software), the price of entry for the OS itself, the OS's stability, the improvement of the graphical interface, and the increase in factory-ready Linux systems, you can expect a substantial growth over the next several months. We believe 2000 will be Linux's crucial year, and by this time next year, users will have a real sense of where the revolution is heading.

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Tell us what you think....How do you like the new products you're using? Second Looks is your forum for feedback. Join us online to tell us about your experiences. We discuss a different new product each week and summarize your comments here. Following are some of your comments from our discussion of the AMD Athlon and Intel Pentium III system reviews.

Nice to see some spirit in the world of systems and processors. The fact that numerous PC manufacturers are running with AMD processors tells the tale. AMD might have fielded a few less-than-perfect processors in the past, but these days it's building a solid engine.

—Marsh

I wish someone would simply test two systems that are as close as possible to the same. You don't say what graphics board the PIII's have, but why not have used the TNT2 Ultra for all, since it's generally the fastest graphics board, at least for the next 5 minutes? I'd be much more impressed with the Athlon being faster if it weren't on an AMD reference motherboard and if it were a full-production system.

—Karl Byriel



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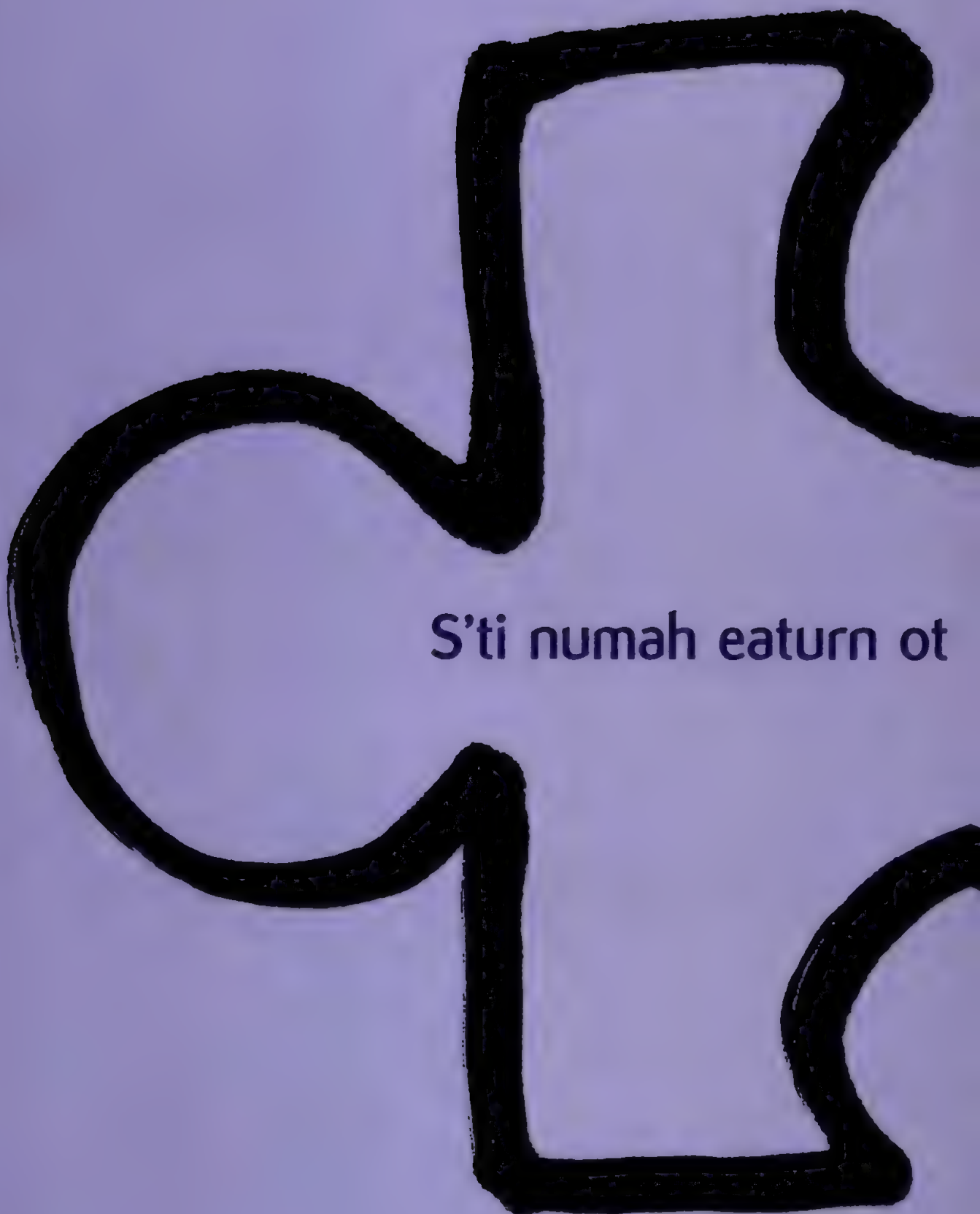
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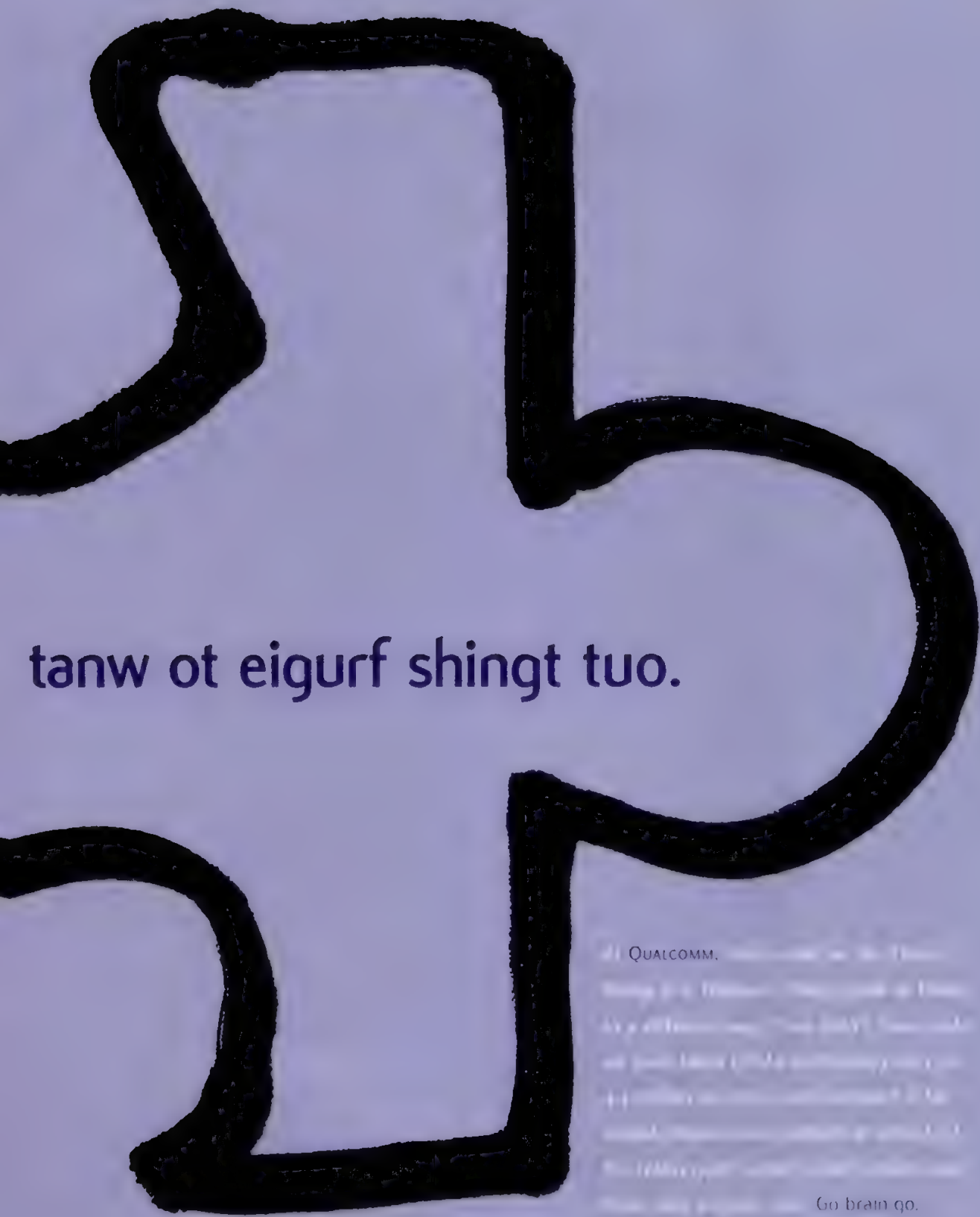
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Forget 1394; It's HPSB Now

Remember FireWire, also known as IEEE 1394? We sure heard a lot about it, how it was going to change mass storage, make printers faster, enable multimedia applications, revolutionize consumer electronics, and facilitate convergence. Almost none of that has happened on the PC platform. Why not?

IEEE 1394 products are alive and well on the Macintosh platform, where it's exceptionally easy to build video-editing suites with the available hardware and software. Several digital video camera manufacturers, most notably Sony, use a version of 1394 for communications among their cameras and other high-end video gear.

FireWire is Apple's trademark for the 1394 standard, which was invented there as a high-performance replacement for the Apple Desktop Bus (ADB), which connected the keyboard and mouse. IEEE 1394 is the standard for the spec, finally approved in 1995, after Apple first drafted it in 1987. The bus is gradually becoming known as HPSB, for *High Performance Serial Bus*.

HPSB is one of the fastest peripheral buses, with speeds up to 400 Mbps now available and 800 Mbps planned. It's especially well suited to video applications, because it can handle real-time (isochronous) data, as well as more traditional asynchronous data. HPSB is a peer-to-peer bus, not a master/slave bus, as are SCSI and USB. (Fascinating trivia: The 1394 connectors were derived from those on the Nintendo Game Boy, chosen for their small size and durability.)

The amount of time that HPSB spent in the oven is part of the delay problem. Many offshoots, subspecs, tweaks, and tunings clouded the picture, as manufacturers put small, proprietary spins on the basic technology. It became nearly impossible for the operating system to deal with all the flavors, so Microsoft has been slow with HPSB support. Manufacturers of HPSB peripherals have had to write their own drivers, which are incompatible with other 1394 drivers and devices. The problem should be solved with Windows 98 OSR1 and Windows 2000, which have (somewhat) generalized HPSB support. Both are designed to support the 800-Mbps 1394 when it becomes available.

OS-level support will finally open the market for HPSB-based mass storage devices, which could spell the end to the progression of ever-faster and ever-wider disk drives: SCSI and Ultra ATA, UltraWon-

derSuper ATA, and so on. HPSB supports 63 devices, all without terminators, special sequencing, or user awareness of device identifiers. But only Windows 2000 supports HPSB printers and scanners.

But what about USB 2.0? The spec—due out October 20—offers a twenty-fold increase in speed, with 200 Mbps or even 300 Mbps attainable sometime next year. It sounds as though USB 2.0 would encroach heavily on HPSB, but consider how badly USB is currently doing on isochronous data transfers. It can't even handle audio, which requires only about 1 Mbps, without glitching.

Also consider how much bandwidth good video really needs. A 640-by-480 picture with 24-bit color doesn't sound very demanding, but at 30 frames per second, it works out to around 220 Mbps. That would pretty much fill the USB 2.0 pipeline, while 400-Mbps HPSB would be only a little over half full.

We fool around with USB cameras on our PCs today, but frankly, they're pitiful. The frame rate is low and gets much lower as you increase picture size. But considering that they're talking dogs, we shouldn't complain too much if they have bad diction. Even with a major infusion of bandwidth, USB will have its limitations. And please, let's not make the dog sing arias by forcing that inherently master/slave architecture to do local area networking. USB has a challenging enough job just replacing legacy ports over the next two or three years.

Relatively few PCs ship with HPSB ports today (kudos to Compaq for its sustained support), but we'll see a lot more by the end of the year. Now that digital video recorder prices have dropped to well under \$1,000, we have an ideal input device for 1394-equipped PCs. And several companies have plans to do PC-based digital VCRs based on HPSB.

After years of fatuous predictions, wheel spinning, and dead ends, the PC-based digital VCR is shaping up to be the first real convergence product. Power, price, phenomenal storage capacity, and, finally, a fast peripheral bus are coalescing to create a unique product, unlike anything that has come before. **PC**



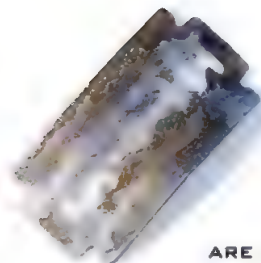
The High Performance Serial Bus is one of the fastest peripheral buses designed, with speeds up to 400 megabits per second.

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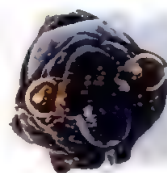
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Microsoft's Dastardly Plot

Microsoft has been in hot water recently with various security problems affecting a variety of products, from Windows NT to MS Messenger to MSN Hotmail. I believe the Hotmail flaw was planted specifically for long-term marketing purposes. It's actually part of a complex scheme to halt the buzz

building around Web-based applications. Hear me out on this one.

The Hotmail breach and story probably began months ago and was revealed when a journalist from Sweden (of all places) stumbled onto a Web site that had a piece of code that allowed you to open anyone's account information and mailbox without a password. Microsoft apologists claim the underlying code was complex, but now the problem appears actually to be nothing more than a back door to the code base that somehow leaked out of the company. Only a select few people ever know about such back doors, and you'd think that whoever it was could have easily been tracked down. But no.

More surprising was the lack of complaints about the breach. We ran this topic twice on "Silicon Spin," and nobody seemed to care. One panelist—Larry Kramer, CEO of CBS's MarketWatch.com—said, "You get what you pay for." It took me a while to realize that this was exactly the reaction Microsoft wanted. "You get what you pay for!" It's free, so it can't be that good.

It was then that I recalled the last "Microsoft enemies" list I saw, which had AOL at the top: "(1) AOL, (2) Internet- and server-based apps, (3) Java- and Jini-stealing developers, (4) alternate PCs—Linux, BeOS, iMAC, (5) stagnation, (6) service-based business model." Web-based applications are number 2! This means they must be eliminated for the benefit of Microsoft sales. No matter that Microsoft owns Hotmail. The fact is, Microsoft loses money on Hotmail and almost all of its Internet activities. The company must have had dozens of meetings looking over the Hotmail revenue model (presented in red ink, for sure) as compared with the revenue model for Outlook as a subset of Office.

What's coming down the line is worse. When.com, the Web-based scheduler and address book, is just one of a slew of Web-based applications that are expected to flood the market, and they all directly impact Office in some way. In fact, they impact the desktop computing model Microsoft relies on.

Microsoft has also kept the Hotmail home page stark, without the usual fill of ads and promotions. "They sure can't be making any money with this" is the first thing that comes to mind. Because Microsoft dominates the free e-mail systems, all the others have copied its stark layout. What's the underlying message? "There are no ads on these pages, because only tightwads who never buy anything use free e-mail. Why advertise to them? Losers!" You also get the impression that any one of these free e-mail systems is going to close up shop any minute, leaving you with a dead box. You'll never see that all-important memo telling you that you've inherited millions. "Hey, you get what you pay for!"

When Microsoft first bought Hotmail, Web-based applications were a new concept. Sure, Scott McNealy was saying how you could do word processing and spreadsheets on the Web with Java (yeah, right), but Microsoft knew this was nonsense—at the time. But if online mail systems as well as scheduling and address book systems caught on, then perhaps someday we would be doing word processing on the Web. To make the company more panicky, it discovered that its own operating system Windows NT couldn't handle the Hotmail load, and it had to use Unix computers to keep running. This wasn't good either.

I was always baffled by Microsoft's buying Hotmail. It was said that the company would use the buyout to get Hotmail users to join MSN. Seemed desperate. In fact, since AOL tops the enemies list, one of the reasons may have been to wean users off of AOL mail and off of AOL altogether. There may have been a little of that, but my thinking now—since the security breach—is that Microsoft wants to submarine the category if it can. What better way than to be a part of the category and do it in from the inside, innocently? And the best way to scare people is to make it look dangerous and vulnerable. "Do you want your personal information on some server on the Web? Look what happened at Hotmail!" Can these guys market or what?



My thinking now—since the Hotmail security breach—is that Microsoft wants to submarine the category if it can.

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INSIDE TRACK

Hopping Mad Dept.: In September the top so-called white box builders met at their so-called System Builder Summit in Boca Raton, Florida, to hash out new trends in building PCs and to complain about Microsoft. These white box builders are companies of any size that build no-name or off-brand computers to compete with Compaq, Dell, Gateway, IBM, and the other first-tier box builders.

There are an estimated 40,000 white box builders, ranging from mom-and-pop operations, calling themselves third-tier suppliers, to companies selling **hundreds of millions of dollars'** worth of gear and calling themselves second-tier suppliers. Some are well known, such as Everex; most are not. It is estimated that these folks do a combined sell-through of 8 million computers a year, mostly unbranded.

Many of these companies are regional and add a lot of personal service to their sales efforts, which Dell and Gateway can't match. And they all have one thing in common: **They hate Microsoft** passionately. They don't hate Microsoft for its software but rather for its **unfair pricing**. According to every vendor I talked to at this event, Microsoft is overcharging them, "because it can."

Microsoft allegedly makes a sweet deal with the top-tier vendors, according to the white-box folks, charging them \$35 to \$45 for Windows. These small fries pay \$70 to \$80. When **confronted** with this discrepancy (and I think this is what annoys these white box guys the most), **Microsoft denies it**, saying that everyone pays the same price. At the previous summit things got so heated during an exchange with Microsoft representatives that Microsoft **banned the press from this year's luncheon talk** for fear of bad publicity.

The talk of this year's show was the marketing of Windows NT, and how Microsoft made **another sweet deal** with the first-tier players, selling them Windows NT for the price of regular Windows and charging the second- and third-tier buyers \$160. So, few of these lower-tier companies even want to sell Windows NT, which apparently **surprises Microsoft**.

Then there is the issue of Linux, which is kind of muddy with these folks. They don't fully understand the Linux concept and open source in general, and there's a **moderate amount of complaining** about how Red Hat in particular can't seem to do the kind of bundling deals necessary to create an alternative OS environment.

In fact, these white box builders should simply produce their own clone of the Red Hat package and distribute it for free with all their machines, in an attempt to wean people off of Windows, which is what they would like to do—or at least say they would like to do. They have yet to think in terms of a combined effort to pressure

Microsoft. Instead, they work out of fear, saying Microsoft will somehow make their lives miserable. **I'm no communist**, but I think collective thinking, instead of complaining, would go a lot farther. End of lecture 8,761.

How About This for an Idea Dept.: What are the chances of Microsoft's getting knocked out of the box by a competitor? Not just any competitor, **but China Inc.?** It recently announced a Windows CE killer called **the Hopen OS**, and Motorola has made this the OS of choice for the PowerPC 860 chip.

Hopen, which is a combination of the words *hope* and *open*, is designed to compete with embedded operating systems, specifically Windows CE as used in set-top boxes and other devices. According to an *EETimes* report, the Chinese Academy of Science Software International (CASS) in Beijing developed Hopen over the past five years. One **must assume** that there are other, more elaborate software operating systems being developed in China. Wouldn't you think?

Then There Is the Memory Situation Dept.

It was at the builders' summit that I heard the first real numbers for the **sudden hike in the price of memory**, even though the industry has been fearing this for months. The wholesale cost of the 128MB PC-100 module was \$90 a week before the summit and \$200 a week later. The prices were apparently **continuing to rise**, and we can expect a crisis shortly. System vendors will ship products with inadequate memory to cover up much of this. So end users won't notice the crisis immediately.

But they will surely notice if they use digital cameras. **The huge demand for digital cameras** at higher pixel resolutions has **swamped** the flash

memory makers. According to Semico Research, the growth of flash is phenomenal, and it will be a \$6 billion market by the end of next year! Manufacturing lead times are as high as 26 weeks, with most makers sold out for the rest of the year.

Semico sees a market growth pattern that looks to be **doubling every 3 years**. This projection may be conservative, because Moore's Law tells us that the pixel resolution will double twice in that period of time. Memory requirement increases will match resolution increases; thus flash requirements should more than double as people demand more and more memory in their cameras.

I've also noticed that I take more high-resolution photos (with minimal compression), which also puts pressure on memory requirements. Finally, let's not forget the potential **new uses of flash memory** and Sony's incorporation of its flash stick into some movie cameras. The way I see it, and the way things are going, this is going to become a **serious long-term problem**. PC

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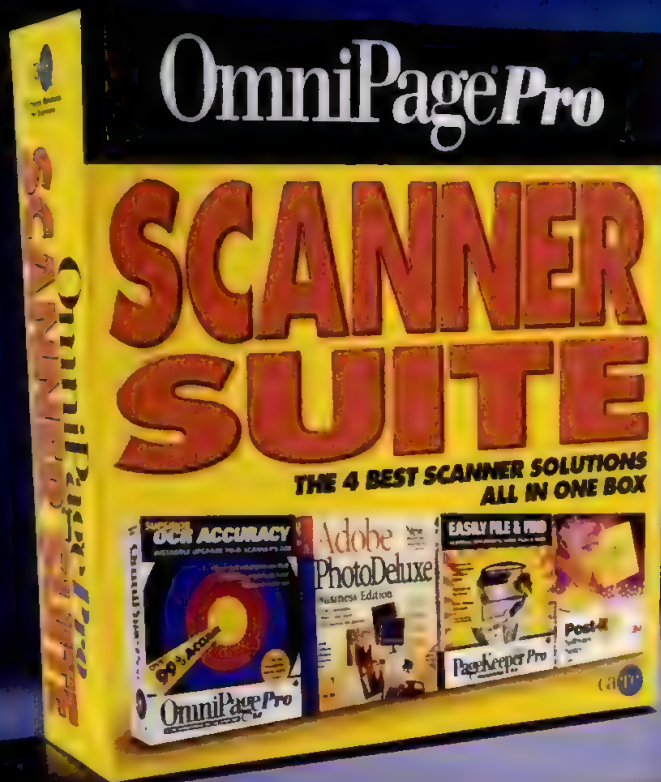
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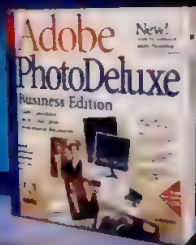
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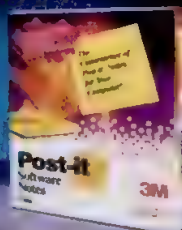
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Ready for Web Apps?

If you bought this magazine on a newsstand, that may well have been because of our big cover-story package on Web-based applications. If it came in the mail, you may still have been grabbed by the same cover plug for the story.

The application service provider (ASP) phenomenon has materialized faster

than almost anyone in the PC business predicted, and we're proud of our coverage in this issue. But the notion of "renting" your software applications through an ASP has its pitfalls, not all of which are evident. So I want to take a minute to argue a little with that Seymour guy, whose story (page 100) kicks off this issue.

To be sure, Web applications have a lot to offer. For in the right company, Web applications offer solutions simply not available any other way. Small companies can use just a few seats of big-enterprise-style apps, rented through an ASP connection, to compete with the Big Boys. (Maybe not quite making the playing field level, though: That involves access to financial and human capital, markets, and more, which may simply be unavailable to small businesses, no matter what runs on their PCs.)

But I'm wary—in some ways extremely wary—of blindly following the Web applications path. Especially right now, so early in the game. And especially for some classes of software.

Indeed, the whole Web applications model is uncomfortably reminiscent of the time-sharing era. We used to hook up our dumb terminals to the big iron, from whence all wisdom (or at least all code) and all data came. We never thought about things like carrying our computers around with us or home for the weekend—how could you do that? No company would consider giving you access to its corporate data assets from off the premises, even if it were possible to tote one of those clumsy terminals home and find some way to connect it remotely.

Today the prevailing model of business computing is far more flexible. I know many all-notebook or nearly-all-notebook companies, where employees' use of notebook PCs is no longer surprising and where you have to make a heck of a good case to get a desktop. The very considerable value added in being able to tote your machine around—whole and complete, with everything you need to do serious work right on that machine's hard disk—hasn't escaped our bosses. It may have taken them a while

to get it, but now they do, in increasing numbers.

Which leads to my biggest reservation about the Web applications model—or as I often call it, "tethered computing." I *like* that we've broken the once-essential link to the mainframe (or minicomputer) we relied on in that shared-logic world. I *like* that I can use my computer just as effectively from my desk, my car, or a client's office or when sitting up in bed at 11:00 P.M. making one last e-mail check.

Of course, I can't check my e-mail without some kind of tether: a connection to my e-mail source, whether that's an ISP or a corporate Lotus Notes box. In other words: Yes, I still often need some kind of connection to get the most out of my notebook. We live in a connected world.

But I don't need that for *everything*. I can write a memo, a novel, or one of these columns; I can log my expenses on a business trip or run a cash-flow model; I can what-if with my investments; I can check and change my daily schedule; I can look up contacts' phone and fax numbers; I can do all that while sitting blissfully unconnected in my backyard.

And boy, do I like that.

All this is possible only because my notebook PC has all the apps I really rely on. I can boot 'em, create and manage with 'em, and dump 'em, all without a tether to anything else, anywhere else.

But if I were relying on Web applications, that wouldn't be the case. No handy phone line or network outlet. No connection, no work. In other words, *dead in the water*.

And boy, do I hate that.

Losing that independence, the freedom to move around, and the flexibility to decide when, where, and how I use a computer would hurt me a lot. So yes, I do have serious worries about how relying more on Web applications will affect our workdays and workstyles.

A case against using Web apps isn't really that clear-cut, of course, any more than the case for using Web apps is. I tried to make that obvious in the cover story, but I want to underscore it here as well. This is



I can do a lot of what I need to do while sitting blissfully unconnected in my backyard.

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a matter of carefully picking and choosing your targets and your opportunities.

I have happily used when.com, and I recently changed over to AnyDay.com, which I prefer. Both are good remote-access calendar-and-contacts Web applications. I also have an extra, personal Web-access e-mail account with MSN Hotmail, and I've been fooling with Storage-Point.Com, which provides a kind of safety deposit box on the Web for temporarily stashing files. And I sometimes use Net-Studio.com for quick graphics. All five, by the way, are free.

But I haven't given up Ecco Pro for contacts, Microsoft Outlook 2000 and my POP3 e-mail account with my ISP, or my DAT drive and associated backup software. Not by a mile.

I do think that over time, I may migrate to AnyDay.com for keeping my schedule; I like it, period. MSN Hotmail is likely to remain my free e-mail provider of choice. I'll probably continue to use NetStudio.com occasionally, though I like NetStudio's regular graphics package a lot better. And someday, but not nearly yet, I may rely on an online backup site.

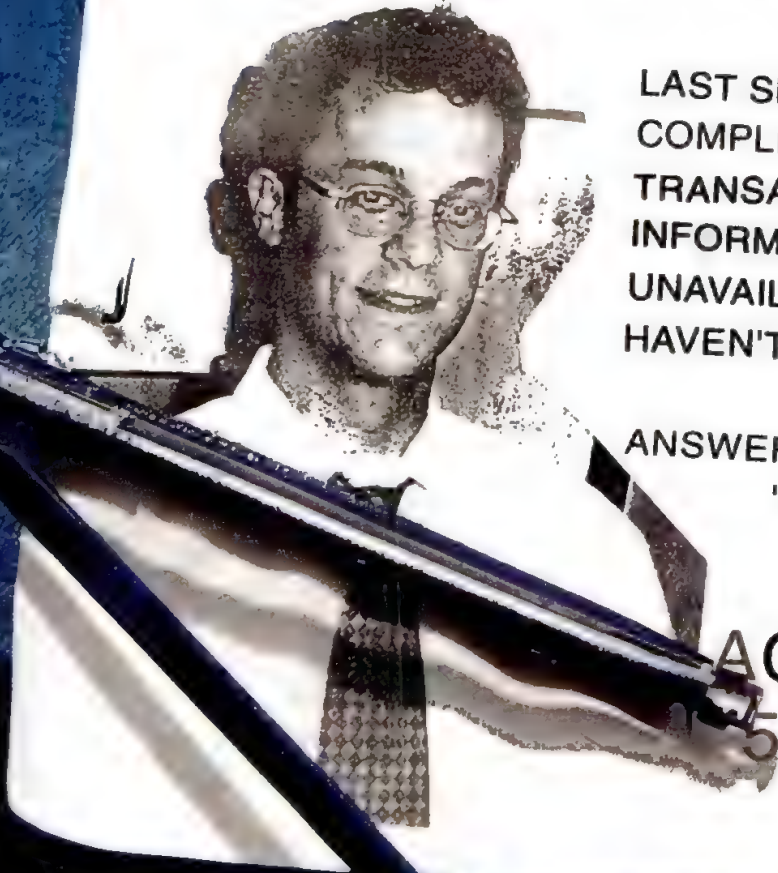
My word processor or spreadsheet—or any of the several graphics programs I rely on—as Web apps? No way. Because then I could only use them when I'm able to connect to the Web. I'm still years away from a full-time, persistent, 24-hour-a-day, anywhere-I-go Web connection.

Three years ago, I sat with others as a gonzo programmer told us how he wanted to move his whole life onto the Web. He wanted, he said, to be “free of the burden of possessions,” owning nothing, possessing nothing, with everything in his life save his clothes and car stored on the Web, where he could of course get at them instantly. For him, “everything” had been reduced to electrons, not atoms.

I sat, rapt, horrified, hating the idea—we all did—but recognizing that a new order was emerging: people who want to live their lives on the Web.

That's not for me; similarly, for my primary applications, Web applications aren't for me. What about you? **PC**

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** Stanford Resources, Inc. Monitraz U.S. Desktop PC Independent Monitor Shipments Q2 '99 and Display Search, Quarterly Supply vs. Demand Study: Desktop Monitors Q2 '99.

Better Baggage

Why should you settle for the black vinyl bag offered by your laptop maker? You could take a step up in security, style, and carrying capacity with a bag of your choosing. We found good bags that can be purchased for less than \$70, as well as all-leather works of art for around \$700.

Finding the right size may be tricky, though. More bags now offer padded or suspended carrying compartments to protect your notebook in case the bag falls onto a hard floor. But those can cost you a great deal of space, and you may be tempted to remove the inserts. There may be trouble with fitting 15-inch-display notebooks; these notebooks typically measure 2.3 by 12.5 by 10.5 inches.

Here's our take on some carrying bags, backpacks, and rolling bags put into daily use by *PC Magazine* staff members the past several months. Except where noted, all hold 15-inch-display notebooks.

Best affordable shoulder bag. The Kensington Skyrunner (www.kensington.com, 800-235-6708). The nylon fabric looks expensive, but it's only \$69.99 list and, at 2.4 pounds, is a pound less than some nylon bags.

Best affordable backpack bag. The Kensington Saddlebag looks great, converts to a shoulder bag, has a nice padded handle, holds a lot, and doesn't look like a computer bag. What more could you want for \$89.99 list?

Best high-end bag. Most anything from Hartmann (www.hartmann.com, 800-331-0613) or Tumi (www.tumi.com, 800-322-8864). Hartmann bags are especially light in ballistic nylon. Try the Hartmann Deluxe Computer Organizer 517 (\$325 list in nylon, \$595 in leather) or the smaller Hartmann Ultra Computer Brief (\$295 list, \$555 in leather). Note that you can't use the smaller one for 15-inch-LCD notebooks. Tumi uses heavier materials and nylon slings, which make its bags—such as the Tumi Safecase Adjustable Computer Brief 2632 (\$395 list in nylon, \$550 in leather)—heavier and taller than the Hartmann bags.

Best high-end backpack. The top of the Tumi Safecase Deluxe Computer Briefpack 2640 (\$295 list in ballistic nylon, \$495 in leather) is a zippered, 4-inch-tall domed pocket for the small items that otherwise fall to the bottom and get lost. A U-shaped elastic sling holds a 14-inch-LCD laptop without taking up much room (bigger notebooks fit, but barely).

Best higher-than-high-end bag. Glaser Designs

(www.glaserdesigns.com, 800-234-1075), an eight-person San Francisco shop, makes bags that exemplify the breathtaking work you can still get from skilled craftspeople. The Glaser A4 City Tote (\$600 direct, plus \$90 for padded inserts) is spacious without being too big; women may like it in black leather with nickel hardware.

Most rugged bag line. Overall, we were most impressed with the Tenba line (www.tenba.com, 718-222-9870), but you'll be giving up internal space to the well-padded corrugated-plastic inserts. Tenba has a neat accessory backpack harness for its shoulder bags that looks like Brandi Chastain's sports bra. Hartmann and Tumi bags should also hold up well. We also liked the more affordable if less exciting ballistic nylon lines from Brenthaven (www.brenthaven.com, 800-803-7225) and Codi (www.codi-inc.com, 800-263-4462).

Outdoorsy bags. Every bag we saw from direct suppliers Eddie Bauer (www.eddiebauer.com, 800-789-1386), Lands' End (www.landsend.com, 800-356-4444), and L.L. Bean (www.llbean.com, 800-221-4221) was well made and well priced. We especially liked the L.L. Bean Sportsman's Deluxe Computer Briefcase (\$139 direct) and the convertible Eddie Bauer Laptop Backpack Briefcase, a bargain at \$58 but a tight fit for 15-inch-LCD notebooks.

Overrated. Market leader Targus took over Port (www.port.com, 800-242-3133), an innovator in protective cases. High-end bags such as the Port Sport Classic are still good, but the Port Computer Backpack (\$79 list), with a domed pocket (like the Tumi backpack's), felt stiff, and the zippers were hard to work. The CourierWare Super Deluxe Courier Bag (www.courierwareusa.com, 800-678-2247) was well constructed, and the available colors were neat—but we're perplexed that *The Wall Street Journal* top-rated it recently. There aren't many inner pockets; the optional insert is more like a padded envelope; and although the basic bag is \$95, you'll need to spend another \$45 for the insert and \$12 for a shoulder pad. **PC**



Our take on carrying bags, backpacks, and rolling bags put into daily use by *PC Magazine* staff members.

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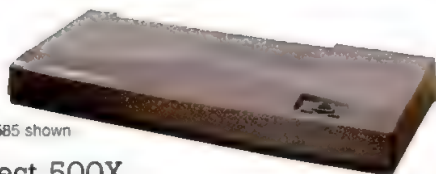
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Send OUT FOR SOFTWARE

web applications

Rentable and even free applications over the Internet are going to change the way you acquire and use software. Here's how it's going to work and what you need to know.

By
Jim Seymour

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Remember when computing was a green-screen terminal connected to a big mainframe someplace where both the software and the data lived? Maybe you don't (ah, sweet youth), but that was how it worked before the personal computer. The advent of the IBM PC in 1981 encouraged software makers to break away from that tethered model and to write software that was wholly resident on a PC's floppy or hard disk, so the user could work without any link to a central computer.

Well, dear readers, we're going back to the future.

The age of the personal computer is over; it's the Age of the Internet, and the rules have changed. Businesses, consumers, and software developers are realizing that the Internet can be the vehicle for running many of the applications that we currently run from our hard disks.

That sure sounds a lot like the old days. Graybeards point to the terminal/host time-sharing model and even the more recent network computer idea from Oracle and Sun as precursors of this Web-based computing. And they have a point:

In each case, that link to the server is critical.

Consider the wild successes of Web-based mail services like MSN's Hotmail and online calendars like When.com. Why are these browser-based alternatives so popular? Certainly part of the appeal is that they're free, but free Windows-based counterparts have been around forever. You cannot discount the power to access your data from any computer anywhere (without having to install anything) as the reason why these programs have been a major draw. And on the back end, there's no need to set up and maintain servers; the service provider is taking care of that for you.

So no client to install, no server to install, and access from anywhere. Smells like nirvana.

But how far can this Internet-based model extend? You may be surprised. Virtually every major software developer is currently figuring out how it can deliver its applications over the Web. The spotlights we offer into particular application types throughout this story showcase the activity and opportunity—in everything

Illustrations by Jeff Fohl

Web Apps:

THE GOOD, THE BAD, AND THE FUTURE

How will the implementation of Web applications in your business affect your bottom line, productivity, and day-to-day operations?

The role of IT changes



Since applications are automatically updated, your IT department doesn't have to worry about supporting multiple versions of a product. The automatic upgrades will also deliver new drivers, new help files, and new features.

► On the downside, your company is essentially forced to upgrade, whether it wants to or not. Because traditional applications are stored locally, a company is free to use those applications for as long as it wants. But Web applications are more like a service: If a company stops paying, that's it—no more application.

Securing your data



Many of today's Web-based applications allow you to store data on local machines. But to utilize the options associated with Web applications fully, companies may choose to store some data on a remote server.

► This will reduce overhead costs, but it may leave your data vulnerable. Make sure your ASP's security is sufficient.



Save money now, pay later

Up-front costs will likely be lower for Web applications, but the long-term costs should even things out, or even prove higher. The Web application pricing model usually involves putting some money down, then furnishing monthly payments to continue using the product. Over a two-year period the costs will be about the same.

► A company that rarely upgrades its software, however, will likely end up paying more for Web applications.



High-speed access a must

Before you choose to go with any Web applications, make sure you have high-speed Internet access in place first. But you also need to consider whether the Web applications you select work over slower dial-up connections for telecommuters and road warriors.

► And no matter the connection, demand that the ASP you choose deliver reliable access to your applications (without servers going down, and so on). Giving up that local access could mean giving up a lot of productivity otherwise.



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Spotlight on

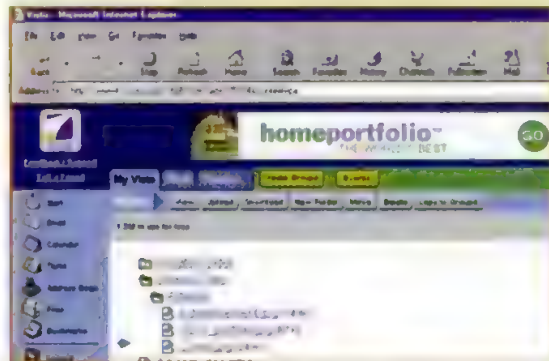
VIRTUAL DESKTOPS

It's the digital equivalent of leaving your wallet in a different pair of pants. You need an important e-mail or document while you're at work, and it's on your PC at home. This doesn't have to happen anymore. Virtual desktops aim to give you Web-based, server-stored versions of the applications that run your life—e-mail, calendar, day planner, and file storage—so that you can access your information anywhere, anytime.

Even while traveling, a business user could add new entries to an address list, update a schedule, and even download a PowerPoint presentation. And instead of trying to make difficult remote connections to the company server, a businessperson could take advantage of file-sharing options and calendar functions to coordinate easily with coworkers back in the home office. Best of all, every virtual-desktop Web site offers these basic functions free of charge.

The best implementation that we've seen is the offering from Visto (www.visto.com). Visto offers an exceptionally clean, easy-to-understand interface that makes the standard functions accessible to the average user. But you'll also find plenty of extras. Visto is one of the first sites to synchronize and import existing address lists from Microsoft Outlook and the Palm desktop. Visto also lets you share files or open your calendar to others who are not Visto members. For example, you may decide that a guest can read your calendar but not enter new appointments into your schedule.

There are other virtual-desktop Web sites to choose



Visto lets you control access to your files by organizing them into private and shared folders.

from, several of which have spiced up their basic offerings with unique services. StoragePoint (www.storagepoint.com), for example, compresses files for faster transfer and more efficient online storage. MagicalDesk (www.magicaldesk.com) can automatically convert an e-mail message into an item on your to-do list. And Zcentral (www.zcentral.com) features an auto-updating address book that can pick up the most current information from other Zcentral members.

These services duplicate many of the functions you already have, but they're more integrated. The ultimate goal here is to replace the standard desktop with a Webtop. Desktop.com, expected to be live by the time you read this, most clearly maps out the future of these services. Desktop.com will supply the essential apps (e-mail, calendar, and so on), but it will also allow other developers to publish Desktop.com-compatible applications, such as to-do lists and news tickers. Users can then add these online apps that share the look and feel of Desktop.com to their virtual desktops. —Luisa Simone

from e-mail to ERP—for small to medium-size businesses to move to the Web application model.

TURN, TURN, TURN...

Throughout the PC era, little has changed in the way we've run our software: We buy the application, we install it on our computer, and off we go. The software

developer then updates the program, and if we want it, great, we buy the new version and start over. If not, well, that's okay, too. Just ask all those folks still using 1982's Lotus 1-2-3 Release 1a.

If we go the first route and always install new apps on our systems, we have the latest and greatest but we endure other costs. In recent years, we've become

acutely aware of the real costs of constant upgrading: Beyond the cost of the software, there's endless maintenance, training, and support.

Stick with the old stuff, though, and eventually you may discover that the vendor is no longer supporting you. Software companies hate it when you don't upgrade. They already suffer from a chronic boom/bust cycle, as they ship new versions and collect lots of revenue, then slip into low-revenue mode while they create the next version, then ship it and wallow in cash again, and so on.

So instead of trying to get you to buy their programs, software companies are

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Graphics creation has gone mainstream. Can the Web save you money?

Spotlight on GRAPHICS SOFTWARE

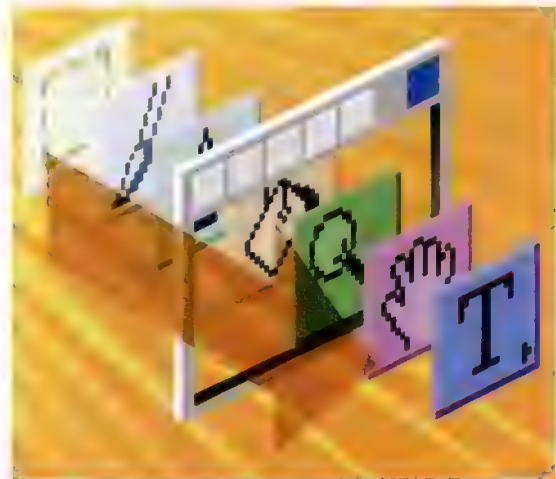
Producing Web content, be it Web-based documents or even multimedia presentations, is increasingly becoming part of everyone's job description. But you may not want to invest in graphics software, because you really don't need it often enough to justify the expense.

Sensing an opportunity, a number of Web applications have arisen that cater to this occasional market. Don't expect the functionality of Adobe Photoshop, but when you need a snazzy GIF for a Web page, these services can help. Bandwidth limitations and usability issues still need to be addressed, but this market is no doubt emerging.

Restricting the type and file size of the content that you transfer over low-speed connections has generally solved the issue of limited bandwidth. This is often done through the intelligent use of templates, which let you plug small chunks of data into preformatted documents.

For example, Web-based graphics programs such as NetStudio.com or GIFWorks.com help neophyte artists create banners, buttons, headlines, and photo treatments. Using NetStudio.com, a free Web-based version of an \$89 graphics program, you simply choose a design, add text, and import a photo ideally suited for the Web. [NetStudio](http://NetStudio.com) produces GIF and JPEG images that have been optimized for the Web, so downloading the final artwork is generally an efficient process.

Moving to video still requires a fast connection. JavuNetwork (www.videofarm.com), an online video-editing suite, will digitize and upload your video for you, but a high-speed connection is still a necessity in order to



see real-time previews of your clips.

Unlike some of the template-based graphics programs, Javu provides a traditional video-editing environment (for \$89.99 per month), complete with multiple palettes, preview windows, a timeline editor, and drag-and-drop functionality—all via the Web, using Java. If you don't have experience with video-editing products, you'll face a difficult learning curve. The real benefit of this Web site is the 1GB of online storage and video-hosting services it provides.

Most of these tools are aimed at the occasional graphics creator, but Extensis, a leading developer of Photoshop plug-ins for professionals, is starting to roll out online versions of its plug-ins on its recently launched creative-pro.com Web portal.

If your needs are not too elaborate and you need to create Web content, you can take advantage of Web-based graphics programs without a significant investment of time or money.—LS

going to try to persuade you to rent the apps you need.

Renting software instead of buying it may seem odd, but the story is very compelling, especially for small businesses and individuals. There are a lot of things to like about using software via a "live" online link to an application service provider (ASP). Of course, it's not all sweetness and light: There are some—well—dodgy things about renting and using ASP links and Web apps.

WHICH APPS ARE WEB APPS?

The programs that will move to the Web vary in size and scope, but some trends

are emerging as to their shared characteristics. Applications like accounting programs—form-based and database-driven—can be efficiently delivered over nearly any speed Internet connection and with an interface that's not terribly different from what the desktop version offers. All that's sent back and forth from the back-end server is some text or forms data; the complex program logic and processing happen at the server.

Infrequently used applications are also well suited to being Web apps. If you only need driving directions every now and again, why go out and buy DeLorme's Street Atlas USA when you can just hop

to MapQuest.com and get the same information? Tax preparation software, for example, typically arrives once a year, and often goes through several rounds of last-minute, postrelease but pre-filing-deadline changes. Last year, Intuit introduced TurboTax Online, a version that lets you prepare and file your taxes entirely within your browser.

Programs that you want to use but aren't sure you really need are another interesting example. If you've ever tried to return an opened box of software, you know that you need to pick your apps wisely. Web applications offer a great model for occasional users as well as toe

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Microsoft Office via the Web. It may sound crazy, but you can use it today.

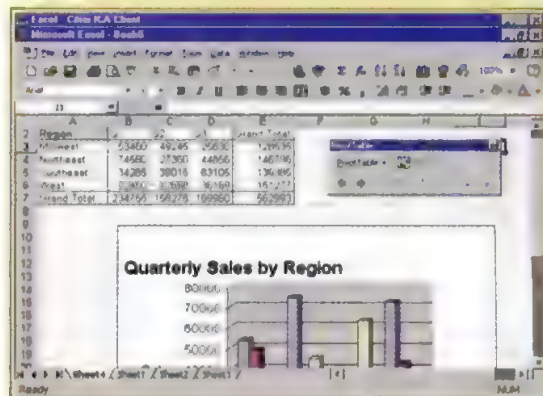
Spotlight on PRODUCTIVITY APPLICATIONS

At first, the notion of using large productivity applications like Excel or Word over the Internet inspires puzzlement, especially if you use them all day. But delivering a Windows experience over the Internet, and Microsoft Office applications in particular, can make a lot of sense for your business.

You can alleviate the need for an IT department, which would otherwise be responsible for maintaining and upgrading your desktops. You can reduce hardware costs: You won't need the latest Pentium IIIs to run the apps you need, because you'll be accessing them using a thin client that can sit on almost any old PC. And you can reduce the number of seat licenses you need for productivity software, letting remote users get what they need without any significant additional cost.

The dominant way for you to access Windows over the Internet is to use technology from Citrix Systems. Using a Citrix multiuser application server, you can access any Windows application over the Web as if the app were on your desktop. Citrix's Application Launching & Embedding (ALE) technology makes the rich experience possible, while maintaining a very thin client. The client is a simple installation and available as either a plug-in, an ActiveX control, or a Java applet. More than 50 ASPs support the Citrix technology; we tested it through ASPs eSoft and Future-Link. We focused on using Microsoft Office applications during our testing, although it's possible for an ASP to host any application for you.

Performance is the biggest issue. You will not get the



The Citrix client is a thin layer that lets you access Windows apps as if they were on your desktop.

same level of performance that you are used to with a desktop application. We tested over a variety of connection speeds, from 56Kbps to T1 speed. Over a 56-Kbps connection, we observed a noticeable lag in response as we typed. This lessened considerably over a faster connection, but we never felt that we got the same level of responsiveness as when using the applications on our desktop.

Citrix says that you can use its client on any PC with at least a 286 processor and 640K of RAM. We tested using everything from a P/166 to a 600-MHz Pentium III, and although the slowest machine exhibited more lags than the fastest, the experience was no worse than any other browser function on that machine.

Using productivity applications over the Internet is not for everyone. You'll need to weigh the monthly costs against buying the software yourself. You may find that you want to pursue this option only for employees who occasionally use these apps and aren't reliant on them for daily work. —Heath H. Herel

dippers. Sites such as NetStudio.com and HTMLWorks.com offer tools for graphics optimization and link checking, respectively, for the kind of one-time jobs that you need done but that may not be worth a full-blown software purchase.

Right now, most people's pipes to the Internet just aren't fast enough or reliable enough for routine delivery of large applications like Microsoft Office or Adobe Photoshop. But somebody's thought of that, too. Citrix Systems and its partners have already devised a way to let you use regular old Windows apps right over the Internet by shipping only as much changing screen content as necessary back and

forth, rather than the program itself. (For more on Citrix, see "Spotlight on Productivity Applications" above)

And even Microsoft has stated that it is working on a highly componentized version of Office and "Web-based Office productivity services."

WHY THIS IS ALL HAPPENING

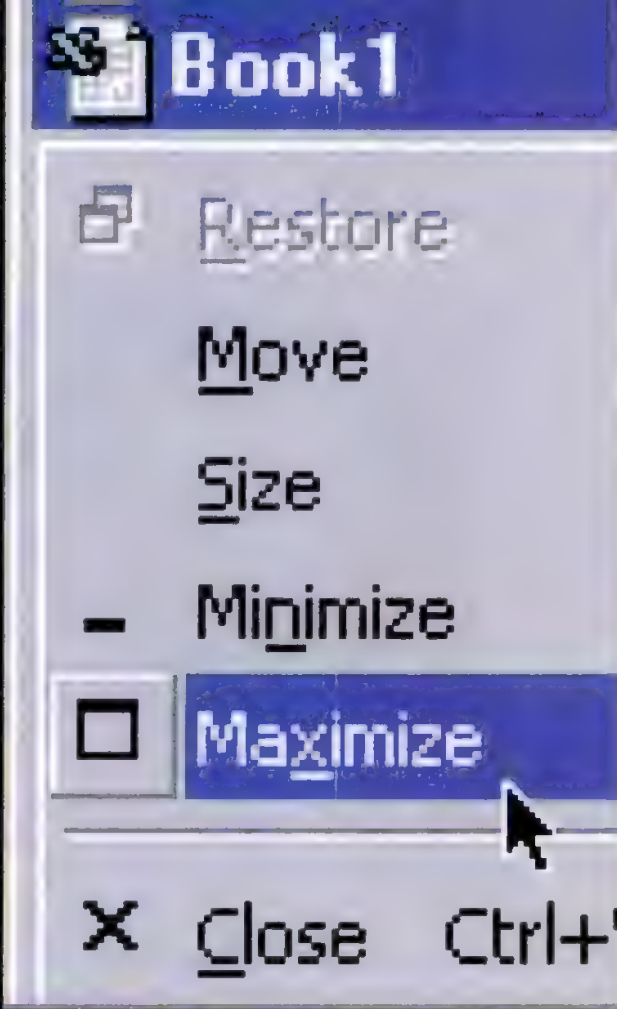
There's more to this story than software companies simply looking for a consistent revenue stream and ways to attract new users, though. In business, outsourcing nearly everything that has to do with IT is a powerful trend. The idea is to cap all kinds of IT costs with fixed contract pay-

ments and get the workers in the outsourced areas off the company's payroll and onto the books of the outsourcing contractor, then sit back and count the savings. Unexpected costs? Um...that's the outsourcing contractor's problem.

To corporate software buyers, the ASP model and Web-based applications are just another form of outsourcing. Even if the outsourcing option looks potentially more expensive than the company's present, in-house operations, corporate management wants the cost of computing to be a known, fixed, predictable sum. Outsourcing delivers that—as does using an ASP for software.

Q4 Totals

92,040
65,640
30,235
27,779
25,900
241,594



productivity

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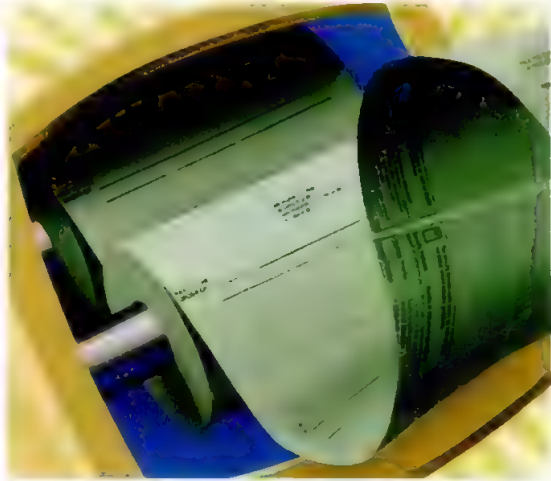
Spotlight on **PAYROLL & ACCOUNTING**

Let's face it: Getting employees paid and balancing the books are a pain, whether the problem is staying abreast of new tax laws or ensuring that everyone who wants direct deposit can have it. The concept of outsourcing these headaches—to a service bureau like ADP or to your accountant—is nothing new. Using the Internet to manage these tasks is, though.

The front-runners to manage your payroll online are (surprise!) ADP and Payroll Online Corp. **EasyPayNet** (www.easypaynet.co) is the Web-based version of ADP's phone, fax, and Windows-based payroll service, and Payroll Online offers the similar **E-Pay** (www.payrollonline.com), an outsourced payroll application. Both products target companies with 500 employees or fewer, and both operate similarly, requiring only a current browser.

If you use the Internet, you don't have to worry about giving any unchanged payroll information over the phone or via fax each pay period; the process is completely automated. Phone and fax customers have to check in manually each pay period even if there aren't any changes. Both services give you the option of printing checks from the Web site, directly depositing them, or requisitioning and receiving paper checks.

Web-based accounting programs that target small to midsize businesses are beginning to emerge. **NetLedger** (www.netledger.com) wants to attract companies with fewer than 25 employees—the QuickBooks crowd—to its browser-based service. Subscribers can either upload data from Intuit's QuickBooks directly into NetLedger or



build accounts from the ground up.

We tested the service while it was still in beta and found the process relatively painless. Data entry and invoice creation were basic, forms-based procedures, and generic reporting, along the lines of accounts receivable, income, and net worth, was also available.

At \$4.95 per month for 10 users and 100 transactions, the price is staggeringly low. If you are using QuickBooks now and are happy with it, however, the only real advantages of NetLedger are its regular backup of your data and access to the latest version with no additional cost.

If you're already outsourcing your payroll and are comfortable with data transfer over the Internet, you'll find that the new Web-based payroll apps can make the process more seamless. If you're happy with your traditional accounting software application, we don't see a compelling reason to make the switch. But if you're shopping for an accounting program, consider a Web-based one. —Sarah L. Roberts-Witt

ASPs go on and on about the advantages of this model: low up-front costs; fixed monthly, quarterly, or annual costs per user; no upgrading, because the latest version is always installed on the ASP's servers; no file-exchange problems (and associated tech-support calls) with multiple versions of a program in use simultaneously. Small companies can finally have access to the big, powerful applications they need to level the field with well-established competitors, because ASP customers only have to buy as many seats, or individual-user licenses, as they need for those big-time apps.

It's a great story: lower costs, more

consistency, better quality, tighter control. And it's playing well in corporate IT shops across America.

SMALLER BUSINESSES = BIG WINNERS

Many ASPs describe their businesses in terms of big companies and big applications packages—for example, SAP R/3 or packages for enterprise customer relationship management. That's a great market, but the ASP approach may be an even better fit for small to medium-size businesses. Typically, these businesses worry even more than their larger counterparts about technology issues, about using new computer tools, and about sav-

ing money. This makes smaller companies good prospects for an ASP sales call.

Business accounting software for this market is one good bet for ASP delivery. Stretch that to include payroll services, with businesses entering pay data through a browser interface and checks showing up in a FedEx pouch the next day, and you've got a very attractive proposition.

In fact, ASP-style online packages are already available from payroll giant ADP (EasyPayNet), among others. And more general ASP-delivered accounting packages are available from Great Plains and NetLedger, and an ASP version of

Color Range...

Feather... Alt+Ctrl

Modify

Grow

Similar



Transform Selection...

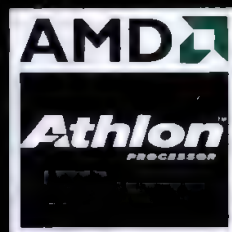
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Small businesses have not had a great way to control employee expenses. Until now.

Spotlight on

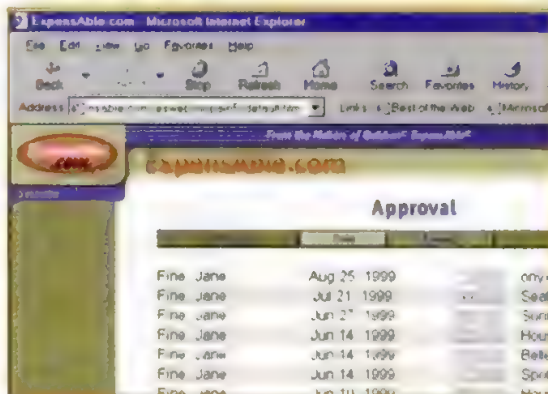
TRAVEL & EXPENSES

Until recently, options for automated travel and entertainment (T&E) reporting consisted of off-the-shelf desktop applications, championed by individual users, or heavy-duty client/server systems, such as those from Captura Software, ConCur, and Extensity. The ASP movement is changing that radically, especially for smaller businesses. On The Go Software, an affiliate of Intuit, is the first we know to offer T&E service to this highly sought-after market, with **ExpensAble.com**, the Web-based version of the desktop T&E software title from Intuit's Quicken line.

Aimed at 25- to 500-employee businesses, **ExpensAble.com** is designed to enable companies not only to automate the data-entry and filing components of T&E but to build centralized data repositories of employees' spending habits. By closely tracking and reporting T&E expenditures, On The Go says small to midsize businesses will be able to derive value in two significant ways.

First, they'll save money through the efficiency of such a system. A recent American Express study estimated that a T&E system can lower processing costs by up to 80 percent and actual dollars spent on traveling and entertainment by 30 percent (by forcing employees to follow company policies). Second, by pinpointing where money is being spent, companies can demand the kinds of discounts from service providers, such as airlines and hotels, typically reserved for larger enterprises.

To get started, On The Go charges subscribers a one-



Approval			
Employee	Date	Amount	Expense
Fine, Jane	Aug 25 1999	...	only
Fine, Jane	Jul 21 1999	...	Seat
Fine, Jane	Jun 27 1999	...	Stair
Fine, Jane	Jun 14 1999	...	Hous
Fine, Jane	Jun 14 1999	...	Bette
Fine, Jane	Jun 14 1999	...	Spink
Fine, Jane	Jun 14 1999	...	Hous

ExpensAble.com lets you view expense information by employee, date, amount, or expense.

time fee of \$5,000; thereafter, the price is \$5 per month per user. Ramp-up includes establishing a set of business rules for approved expenses and service providers as well as individual user accounts and access rights. The latter would enable a sales manager, for example, to view how much his or her staff has spent compared with how much money is in the budget.

We tested the service in various user modes and found it extremely easy to navigate and understand. This isn't surprising, given that the program draws heavily on its excellent desktop sibling, **Quicken ExpensAble**.

On The Go is currently constructing hooks to various accounting systems, such as Great Plains and Platinum, so that data from **ExpensAble.com** can be fed directly into the systems. A turnkey reimbursement module is under development as well. These features will be available early next year. The integration of these features will only enhance the value of moving to such a system. —SLAW

QuickBooks Pro is also expected soon from Intuit.

NetLedger, a small company backed by Oracle founder and chairman Larry Ellison, has adopted an aggressive pricing strategy that shows just how competitive the ASP business is likely to get. **NetLedger** offers small businesses a comprehensive accounting package for just \$4.95 per month (payable annually, in advance, after a three-month trial period), which covers the first 1,000 transactions per month and access for 10 users. This isn't a rinky-dink accounting package; it uses Oracle's highly regarded 8i database back end and is hosted by Oracle's Business Online ASP service.

(For more on Web-based payroll and accounting, see the related spotlight in this story.)

Intuit recently began comarketing **UpShot.com**'s sales-management ASP app, which is free for up to 10 users, then priced at \$1 per day per user thereafter. That's a pricing plan easily understood by small-business managers, and a relatively painless way to get started using ASP services.

IT'S ALL ABOUT THE MONEY

The idea of having to be connected to something somewhere else just to use your computer might still sound strange. In fact, the ASP model can offer both eco-

nomical and practical advantages. The economic advantages of ASP computing are pretty clear. Rather than having to purchase enough shrink-wrapped packages, or likelier, enough *seats* (individual licenses) for everyone at a company who needs to use the application, plus the necessary server hardware and other infrastructure to support the application, a company signs up with an ASP. Office productivity apps can cost as little as \$10 per month—and in the world of big-company, big-price apps, where licenses start in the six figures, companies can now buy access for \$50 to \$100 per month per user.

Those prices can be deceptive, though. Often the real cost of moving to an indus-

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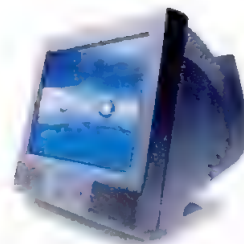
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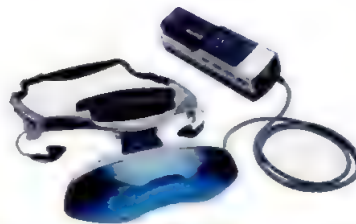


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Managing your employees is a difficult task.
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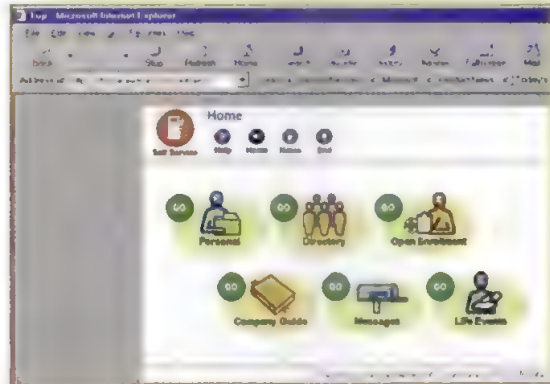
Spotlight on HUMAN RESOURCES

Your small business manages its human resources using a hodgepodge of paper- and spreadsheet-based "solutions" that are really no solution at all. The HR software space is littered with narrowly tailored applications and complicated, expensive ERP modules, neither of which often make much sense for your company.

The Web application model could go a long way toward offering small to midsize businesses a real HR alternative. **Employeease** (www.employeease.com) is the only company thus far that offers a comprehensive, Web-based human-resources application in the traditional PeopleSoft vein. PeopleSoft, of course, does offer access to its HR application via the Web—through the ASP Corio—but it's much more involved than what most small businesses will require. Employeease defines the market as companies with 50 to 5,000 employees; officials there say the average customer has between 200 and 1,000 employees in its organization.

Employeease.com is designed to accomplish two primary objectives. The first is to reduce the paper-based administrative burden many businesses face, which, according to a 1998 Forrester Research study, can consume as much as 80 percent of the human-resources department's time.

The second is to offer employees self-service benefits administration, which means that they can change health insurance plans, update their contact information, and increase contributions to flexible-spending accounts and 401(k) plans through a browser at any time.



Employeease offers a self-service station for employees to update their own benefits information.

We viewed online demonstrations of both the administrative and employee interfaces and were impressed with the potential this program offers small businesses in terms of human-resource management. In the self-service portion, for example, a Life Changes section lets employees update their benefits profiles based on marriages or births.

The cost of Employeease's system is more than manageable for a small business. The setup fee is a few thousand dollars, depending on the number of employees, and the monthly fee averages between \$5 and \$6 per employee. The implementation time ranges from a few days to a few weeks, depending on the size of the company.

Employeease is currently developing partnerships with providers of complementary services, such as payroll and recruiting, and other benefits providers. This will be necessary as ERP players, such as PeopleSoft and Oracle, attempt to seduce the midsize market with their own out-sourced offerings. —SLAW

trial-strength corporate enterprise application lies not in the price of the software license itself, but in the inevitably underestimated costs of integrating the new package with the company's other systems and the continuing maintenance and support of the software.

It's well and good to be able, finally, to buy just a half-dozen seats of a famous, big-time application, but very often, companies have found that the additional work necessary to install such software packages and integrate them with existing procedures and data repositories costs even more than the huge license fees. This cost-of-implementation burden can run so high that even compa-

nies that have committed to adopting a new enterprise application sometimes bail out during the implementation-and-integration phase, tired victims of cost overruns and delays.

On the end user front, many consumer-oriented applications will be free and advertising-supported, but that does not mean integration will always go smoothly. You're probably going to want to pick e-mail and calendar apps that talk to each other, or else you're taking two steps back and not one step forward.

WHAT TO DEMAND OF YOUR ASP

Choosing an ASP application and the firm that will deliver it is a tough job. Sev-

eral national ASPs are emerging as the leaders in the early wave. They include ApplicationStation.com, Arthur Andersen Business Consulting, Corio, CyberQwest (a joint venture between high-tech telco Qwest and the consulting arm of the accounting firm KPMG), EDS, TeleComputing, and USInternetworking.

ASPs are increasingly specializing, usually along vertical-market axes, claiming special skills and experience in the areas served. Corio, for example, boasts a close connection with ERP giant PeopleSoft, though it also offers packages in other areas. (See the chart "Major Application Service Providers" for more on the service offerings of six major ASPs.)

The small guy can now play in the same league as the big boys for a reasonable price.

Spotlight on **ENTERPRISE RESOURCE PLANNING**

Long the domain of the Fortune 500, Enterprise Resource Planning (ERP) systems from Baan, Oracle, PeopleSoft, and SAP are at last trickling down to smaller organizations, courtesy of the ASP trend. An ERP system is a set of software modules that automates and streamlines back-end functions such as inventory management, manufacturing, supply chain, human resources, purchasing, and finances.

In the standard ERP scenario, companies employ an army of consultants to customize the systems. In addition, businesses must acquire the proper quantity of software licenses, sophisticated hardware, and internal staff to maintain the beast. In theory, the ASP model eliminates nearly all of that rigmarole and gives small and midsize companies access to first-rate ERP systems by significantly lowering costs and streamlining implementations.

Not surprisingly, getting started with an ERP system is complicated, even if the system is Web-based. Even though the ERP application is housed at a data center, ramp-up still requires a series of sessions with a consultant from either the hosting facility, the ERP vendor, or a third-party reseller or integrator.

The fee for this is folded into the start-up costs, which none of the vendors would disclose, because the prices vary widely from company to company. You can safely assume that utilizing the setup service is cheaper than trying to set everything up yourself, however, and this saves time, because you don't have to buy the hardware



and get the system up and running.

On the whole, ERP vendors are tight-lipped when it comes to pricing. SAP did reveal that the monthly fee per user (after setup) ranges from \$425 to \$660, depending on the number of modules rented. Oracle bases its monthly per-user fees on the number and type of users, and volume discounts are available. Oracle's fee for employees who use the system daily and edit data within it is around \$900 per month per user.

Each ERP vendor is entering the market with some variation on the ASP theme. PeopleSoft, for example, has aligned itself with the ASPs Corio and USInternetworking, offering its Financials, Purchasing, Manufacturing, and HR modules. SAP has signed up EDS, eOnline, Interpath Communications, and Qwest to make its modules available via ASP.

Smaller companies that need the power of the big guys at a price they can better afford should explore which systems and which ASPs will best work for them.—SLRW

If you're buying just a few seats' worth of a mega-app like PeopleSoft, whom are you going to get to perform that installation and integration work? That's where client companies need to be able to rely on an ASP experienced in working with a particular application. That kind of experience and close working relationship with a single, dominant player in a field can be a huge help in setting up and supporting such sprawling applications.

Corporate IT managers looking at the ASP model and specific providers that sell the apps they're interested in should have high expectations and set rigorous

quality-of-service standards for those ASPs. On one level, this means quick and reliable installations with speedy and affordable integration; on another, it means high uptime for the service. Looking out over an office full of idle thumb-twiddlers, all waiting for an ASP to bring the apps they need back online, is a painful and expensive experience for management.

THE SPEED TRAP

If you're considering an ASP relationship, it's also important to make sure you have fast Internet access in place first for all the employees who will be using the

applications. Bandwidth comes into play in several ways when evaluating and setting up ASP applications. A T1 or T3 line, a fast DSL link, or a leased line shared over a local area network is essential in order for ASP-delivered apps to make sense.

But too often, designers of ASP applications mistakenly assume their target markets consist of customers with entirely homogeneous workforces. That is, ASPs tend to assume that anyone using the app will be sitting at a desktop computer, in the client company's office, connected through the office LAN to the Web on a high-speed connection.

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Today, that's just not very realistic. Say you're selling a sales management application you want to deliver to customers through ASPs. At any given time, a significant number of your clients' employees will be accessing that application through crummy POTS (plain old telephone service) dial-up lines. Forget about even 56-Kbps connections for them; assume that on a good day they'll average 28.8 Kbps or a little less. After all, they'll be dialing in from their homes, from hotels, from clients' offices—all over standard dial-up connections.

So if your sales-management application is only tolerable over a 300-Kbps to 400-Kbps link (or better), your dial-in employees are not going to be very happy. That means interfaces have to be clean and spare, and data transfer has to be limited. That isn't easy.

Solving this goes directly to the division of labor between the connected computers and the ASP servers feeding them. How much code stays on the PCs, how much is server-resident, and how data moves between the two are all critical design decisions that can sink an ASP app if badly planned and executed.

VENDOR-DIRECT ASP SERVICE

Looking at the ASP model as a whole suggests one big question: Why do major software vendors need third-party ASPs to deliver their products to you on a de facto rental basis? Clearly, a company with the resources of a Baan, Great Plains, Microsoft, PeopleSoft, or SAP could set up its own server farm and sell ASP service directly to its end-user customers. Why go through a profit-diluting layer of ASP shops?

Asked directly about this, software companies say that at least for now, they need the ASPs to do the grunt work, the market building, for them. Software developers claim to see the emergence of the ASP model both as a way to level the peaks and valleys of their revenues and as a way to focus on what they do best—writing code.

Maybe, but that tune does sound a little off-key. Some smaller companies, such as Employeease, which offers a Web-based HR solution, already host their own apps, serving as both software developer and ASP. Cynics say the big software shops

Major Application Service Providers

Many mainstream business applications will be offered as Web applications through third-party ASPs. Here are six of the biggest and what they offer.

Company name/URL/phone	Applications supported
Corio www.corio.com 877-267-4627	Customer relationship management Siebel Call Center E-commerce eServices and eSales Enterprise resource planning PeopleSoft Financials Purchasing, Manufacturing, and HR Sales force automation Siebel Sales and Service, e-Services and e-Sales
FutureLink www.futurelink.net 877-216-6001	Accounting Great Plains, Eastern Software Customer relationship management Onyx, Pivotal Databases Progress, SQL Desktop productivity Applix E-commerce Net Perceptions, Galleon
NaviSite www.navisite.com 888-298-8222	Databases Oracle 7.x, 8, and 8i E-commerce Web Trends, Cyber Cash Payment Processing, Microsoft Site Server, Open Market Transact
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will use ASPs for a few years to develop this market, then slowly choke their ASPs to death and move to serving their customers directly.

For users, that might not be so bad: The quality of service and support from the company that developed the software ought to be very good. But anyone who has spent 2 hours on hold with the tech-support department at any of the major developers waiting for someone who in the end wasn't able to answer the question will have a certain amount of skepticism about the quality of vendor-provided support.

Individual ASPs, on the other hand, have an opportunity to prove both up and down the chain—up to software developers, down to end users—the validity of their roles, by delivering excellent customer support. Specialized ASPs also

have a great business opportunity in the installation and integration field. It's going to be an interesting few years for ASPs and their employees, customers, and shareholders.

A NEW PARADIGM

Running your business through a browser and renting software rather than buying it are at first jarring ideas. Why keep paying for something you know you'll need over time, when you could just swallow the bullet once and own the package outright?

It isn't an easy thing to shift our thinking to such a new and different model. New paradigms are always hard. So before you buy or download your next piece of software, consider whether you can get the same thing as a Web app; it may just be worth your while. 

Messaging Service Providers

Staffing

* A messaging service provider has its own staff that eats, sleeps, and breathes mail. * Outsourcing lets your staff focus on your core business. No need to force an already overextended IT department into maintaining another system.

Cost

* You can set budget numbers that include administration, training, and support with certainty. * Over the long term, the outsourcing annuity may be more expensive than the cost of buying a mail server and client licenses.

Flexibility

* You can quickly deploy or discontinue à la carte services, such as virus scanning or antispamming. * MSPs may provide only a limited number of additional or alternative services.

Reliability

* MSPs use multiple servers and have fault-tolerant and fail-over schemes that most businesses can't match. * Technical support is typically 24 hours, 7 days. * Whether you grow gradually or expand quickly, outsourcing centers are built to grow with your business.



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Corporate E-Mail



We'll help you find the right e-mail solution for your business.

We're working in an e-mail-centric world. For many businesses, e-mail is a mission-critical application. If you can't reliably send and receive mail, then you can't communicate with your coworkers, your customers and clients, your suppliers, and your consultants. So your choice of an e-mail system is one of the most important information technology decisions you have to make. Fortunately, now you have more choices than ever.

One of your first decisions is whether to host your mail yourself, using your own hardware and people, or to hire someone else to host and maintain it for you. Some aspects of e-mail operation, such as virus protection, content filtering, and directory management are long-term considerations calling for expertise. Out-

sourcing e-mail is a legitimate alternative with economic appeal. In our story "Outsourced E-Mail," we show you what it's like to contract out your mail services. And you'll see that even if you're not ready to have someone else take over your mail services entirely, you can still unload some of your special needs to a third party.

But relying on outsourced e-mail isn't for everyone. Perhaps you have enough support staff to maintain your mail system. Or maybe you're just not comfortable handing such an important part of your business off to someone with limited accountability. Fortunately, as you'll see in our story "E-Mail Servers and Groupware," the mail server vendors continue to push their products forward. The popular groupware packages, Lotus's Domino R5 Server, Novell's GroupWise 5.5, and Microsoft Exchange Server, are more powerful than ever. If you're not looking for a full-fledged groupware solution, you still have several choices in simple, powerful, and scalable IMAP mail servers.

So study your options. The right solution is out there waiting for you.

By Frank J. Derfler, Jr.

illustrations by colin johnson

Self-Hosted E-Mail

Staffing

- * Your technical staff may be large enough to support the mail system and perform its other duties as well.
- * It may be advantageous to keep expertise in a mission-critical application such as messaging in-house.

Cost

- * Payroll, infrastructure, software purchasing, installation, and support are all expenses you have to budget for.
- * No recurring fees.
- * Be prepared for unexpected maintenance expenditures, such as replacing faulty hardware or upgrading capacity.

Flexibility

- * You can tailor your system to your specifications on your schedule.
- * This is especially important if e-mail is part of a critical business application.
- * Adding personalized services yourself may be cost-prohibitive.
- * Consider hosting your own mail but outsourcing related services.

Reliability

- * It's difficult to match outsourcing reliability, but hosting your own mail gives you more accountability.
- * If the MSP's systems are having problems, you're powerless to do anything about it.
- * If the system goes down, you'll be reimbursed for your subscription fees.



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OUTSOURCED E-MAIL

It can be an inexpensive, easy alternative to hosting your own mail server.

By Frank J. Derfler, Jr.



E-mail is important to many companies, but so are water, power, and telephone services. Yet only in rare instances do companies elect to generate their own power or drill their own wells. If e-mail isn't part of your line of business, why should you invest in the labor and server power to run your own system?

Because of the connectivity available across the Internet, it technically doesn't matter where your e-mail servers reside or who runs them. A gaggle of companies ranging from tiny neighborhood ISPs to the largest of telecommunications carriers would like to rent you a part of their e-mail server complex or to install and manage e-mail servers in your facility. They'll do it with expertise, reliability, and at a cost you'll be hard-pressed to match. Even free e-mail services like MSN Hot-mail and our own ZDNetmail provide browser-based alternatives for e-mail outsourcing for those with the most basic mail needs.

Our reviews show that outsourcing e-mail is a smart thing and that the smaller your company, the smarter outsourcing becomes. Large companies often have enough staff in their IS departments to run an e-mail installation and are usually better equipped to handle growth. Also, as your company grows, e-mail scales up smoothly. But finding and keeping skilled IS people is a problem for small businesses. Small and midsize enterprises can avoid staff costs and benefit from the fixed predictable costs, high reliability, and low hassle of outsourced e-mail.

What does it cost? The answer depends on what you order, but we took a look at two outsourcing alternatives and found prices ranging from about \$5 per seat per month for a good bundle of services to more than \$15 for customized services. The one-time setup fees vary from \$150 to \$1,000. But if using an outsourced e-mail service forces you to upgrade the capacity of your Internet connection and your ISP charges you more, that can mean a significant new monthly cost. E-mail messages are typically short, and delays of milliseconds in message queues or in switches don't matter, so the impact on your Internet connection can be minimal. Under some circumstances, particularly if connectivity is expensive in your state or country, they can install e-mail equipment at your location to reduce the long-distance data traffic.

The major cost of running your own e-mail system is in payroll. One skilled person can run an e-mail system for 1,000 clients. If you pay that person \$50,000 annu-

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- PC World's 1999 Service & Reliability Award from Customer Survey.
- Inspiron 3500 C366XT – PC World's Best Buy in the budget category, 9/99.
- Latitude CPT C400 GT – PC Magazine's Editors' Choice Award, 8/99.
- Latitude CPT A366XT – PC World's #1 Best Buy Power Notebook, 6/99, 7/99.
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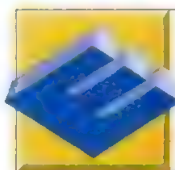
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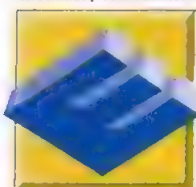
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 E-VALUE CODE: 04181-291052

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- 3Com Super Stack II Dual Speed 500 24 Port 10/100, add \$905
- Cisco 800 ISDN Router, add \$796
- 3Com USB Network Interface, add \$57
- HP Pro Curve 10 Base-T Hub, add \$62
- Cisco 1548 Micro Switch 8 Port, add \$764
- Nortel Networks Baystacks 450-24T 24-Port, add \$2582
- HP Procurve Switch 408, 8-Port, add \$303

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- 40X Max* Variable EIDE CD-ROM Drive
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- Integrated PCI Ultra-2/LVD SCSI Controller
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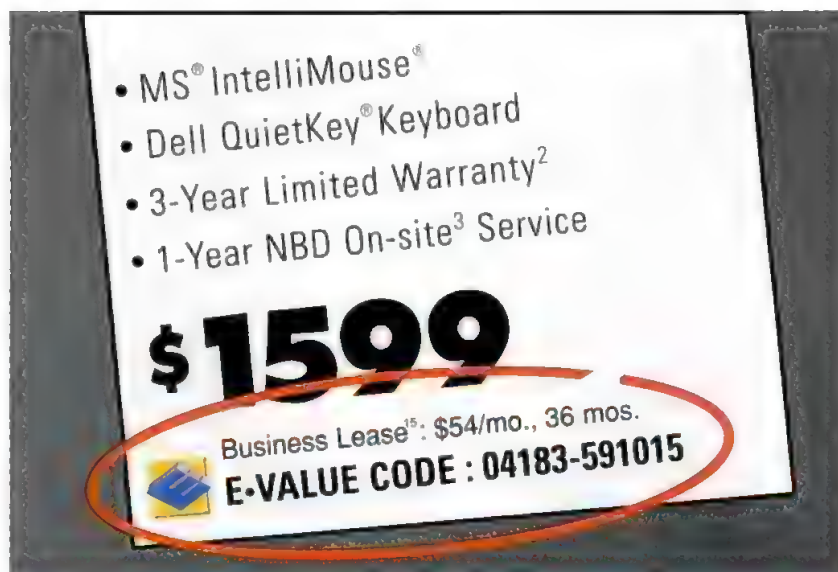
DELL SERVER AWARD INFO

- Network World "World Class Award" -- Dell PowerEdge 6350, 8/99.
- Network World "World Class Award" -- Dell PowerEdge 4300, 7/99.
- Network Computing's "50 Best Products of the Year" -- Dell PowerEdge 6300 (Enterprise Server), 5/99.
- Network Magazine "1999 Products of the Year" -- Dell PowerEdge 2300 (Workgroup Server), 5/99.
- Computer Shopper "Top 100" -- Dell PowerEdge 2300, 11/98.
- PC Computing's "The 'A' List" -- Dell PowerEdge 6300, 11/98.

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ally, that's a little under \$5 per seat per month without hardware or software costs. If you have only 100 clients, your per-seat expenses look astronomical. We'll grant that your company's e-mail administrator will spend time doing other jobs, but that one person will have limited knowledge of techniques in areas such as virus protection, privacy, and cross-program interoperability and can't be on call 24 hours a day.

The two main reasons for running your own e-mail system are that you already have the resources because of an existing IS staff and that e-mail is an integral part of your business. In some companies, line-of-business applications generate e-mail orders and confirmations, so e-mail is a part of what they do.

Messaging service providers keep the servers holding your mail in secure facilities, and the biggest vendors have redundant networks worldwide. They have big pipes into the Internet and might install new, dedicated connections to your prime facilities and to those of your business partners. Yet outsourcing may still not satisfy management's need for accountability. While service-level agreements spell out the reliability required and penalties for service failures, you typically get reimbursed just for the cost of the service. No service provider is going to reimburse you for revenue lost during an outage.

This perceived lack of accountability might not sit well in some boardrooms, but it's the same way other utilities work. It's relatively easy, however, to determine when power voltage or water pressure are low, but it's a lot harder to find the source of a slow e-mail service connected across the Internet. In case you're worried about keeping your outsourced e-mail safe, MSPs (messaging service providers) run high-end versions of standard software and have a focused business, and because they have 24-hour, 7-day coverage, odds

Our Contributors: FRANK J. DERFLER, JR., is the senior networking editor of *PC Magazine*. GREG ALWANG and STEVE RIGNEY are contributing editors. Associate editor NANCY E. HIRSCH and PC Magazine Labs project leader DIANE JECKER were in charge of this story.

E-Mail Outsourcing Prices			
For our RFP, we put together a package of e-mail services that includes basic messaging as well as encryption, spam filtering, and virus scanning. Below is what you should expect to pay for typical IMAP and POP solutions. Pricing is based on a 30-user sample company.			
Critical Path (IMAP solution) 877-441-7284, 415-808-8800 www.cp.net		USA.net (POP solution) 719-265-2930 www.usa.net	
Basic mail (including Web mail access)	\$10.00	per user per month for 25MB storage	\$5.00 per user per month for 5MB storage
Encryption (via SSL)	\$2.00	per user per month	\$0.75 per user per month
Spam and junk-mail filtering	—	Included, using Critical Path's spam prevention	Included, using USA.net's internal spam filters
Virus scanning for mail and attachments	\$0.60	per user per month	N/A
Directory services and LDAP	\$0.10	per user necessary for company address book	Includes basic address book and LDAP search option
Calendaring and scheduling	\$3.00	per user per month	N/A
Additional services at additional costs	Varies	Incremental storage; support for 14 languages; professional services; digital certificates; branding; Web mail; POP mail; ability to host Novell's GroupWise, Lotus cc Mail, Lotus Notes, and MS Exchange	N/A
Total monthly cost for 1 user (after setup)	\$15.70		\$5.75
One-time start-up fee	\$1,000		\$150
N/A—Not applicable. The service does not have this feature.			

are they will be in the forefront of efforts to find and plug security holes. No service comes with ironclad guarantees, but these services are in a good position to handle any problems.

Admittedly, outsourcing an e-mail system is more complex than ordering power or water service, particularly because you probably have a specific way of doing e-mail. Someone must size the operation, design connectivity, establish a corporate e-mail identity (usually the *companyname.com* domain), set up individual accounts, establish and manage passwords or other forms of access, and establish policies and practices concerning spam, transmission of attachments, virus handling, and unacceptable content. Then there is training and, finally, transition to the new system. These are the things you should expect your outsourced e-mail service to provide.

Outsourcing isn't an all-or-nothing proposition. We also look at services such as unified messaging, cross-system integration, and protection from spam and

viruses. These services and others are available as add-ons to your internal e-mail system.

We set out to evaluate the offerings of two of the largest e-mail service providers: Critical Path and USA.net. We felt that these two vendors typify messaging specialists in an industry that also contains thousands of small ISPs and broader companies like AT&T and Compaq. Our approach was to generate an RFP (request for proposal) for e-mail services and to evaluate the response we received from these companies.

Both solutions include similar basic services, but USA.net's solution is based on the simpler and less-powerful POP3 standard, while Critical Path offers a IMAP solution that is geared toward mission-critical e-mail. Both companies offer access to mail and administrative services through a browser.

The primary lesson we learned is to carefully read the menu of services. The offer we received from USA.net had an attractive price, but many specialized ser-

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Hard Drive	4.3GB hard drive ¹		8.4GB Ultra ATA hard drive ²		13.6GB Ultra ATA hard drive	
DVD/CD-ROM	40X var. ³ speed CD-ROM drive		40X var. ³ speed CD-ROM drive		40X var. ³ speed CD-ROM drive	
Graphics	8MB nVidia Riva AGP graphics		8MB nVidia Riva AGP graphics		8MB nVidia AGP graphics	
Sound	PCI 64-voice Wavetable sound		PCI 64-voice Wavetable sound		PCI 64-voice Wavetable sound	
Monitor	15" Micron 500Vx (13.8" display)		17" Micron 700Cx (15.9" display)		17" Micron 700Cx (15.9" display)	
Micron University	1-year free ⁴ online training		1-year free ⁴ online training		1-year free ⁴ online training	
On-site Warranty	5-yr./3-yr. Micron Power limited warranty		5-yr./3-yr. Micron Power limited warranty		5-yr./3-yr. Micron Power limited warranty	
Software	Microsoft Windows 98 Microsoft Office 2000 SBE Norton AntiVirus		Microsoft Windows 98 Microsoft Office 2000 SBE Norton AntiVirus		Windows NT ⁵ 4.0 workstation (Free Windows 2000 upgrade ⁶) Microsoft Office 2000 SBE Norton AntiVirus	
Factory Direct Price	\$27/mo. Business Lease 48 mos.	\$889	\$33/mo. Business Lease 48 mos.	\$1123	\$40/mo. Business Lease 48 mos.	\$1338

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— Web Host, E-Commerce Hosts Category; August, 1999



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Hard Drive	4.3GB hard drive ¹ (removeable)	6.4GB hard drive ¹	6.4GB hard drive ¹ (removeable)
Monitor	12.1" SVGA TFT display	14.1" XGA TFT display	15.0" XGA TFT display
Graphics	8MB AGP graphics accelerator	8MB 3D AGP graphics	3D AGP graphics accelerator
CD-ROM	24X var. ² speed CD-ROM drive	4X var. ² speed CD-ROM drive	4X DVD-ROM drive
Extra Storage	3.5" floppy disk drive	3.5" floppy disk drive	3.5" floppy disk drive
Communications	—	56K 3Com Eclipse Lite modem card	56K 3Com Eclipse Lite modem card
Software	Microsoft Windows 98 MS Office 2000 SBE Norton AntiVirus	Microsoft Windows 98 MS Office 2000 SBE Norton AntiVirus	Microsoft Windows 98 MS Office 2000 SBE Norton AntiVirus
Micron U	1-year free ³ training online	1-year free ³ training online	1-year free ³ training online
Factory Direct Price	\$53/mo. Business Lease 48 mos. \$1799	\$74/mo. Business Lease 48 mos. \$2499	\$86/mo. Business Lease 48 mos. \$2899



TransPort NX 366
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TransPort NX 366
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TransPort TREK² C400
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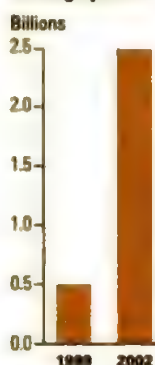
services, including scanning e-mail attachments for viruses, weren't available at review time. Critical Path has the services, but they're priced à la carte or grouped into marketing packages.

In areas such as administration, filtering, and customization, Critical Path offered a full menu of services, but every service has a price. Critical Path's basic IMAP service was \$10 per seat per month. Adding a full load of options raised the price to over \$15 per month. The basic POP service from USA.net started at \$5 per user, and an additional \$0.75 per user for encryption. Establishing office administrative procedures and user e-mail training could augment that service's smaller set of automatic features. We learned that careful consideration and negotiation are as important to successful outsourcing as technical skills. Outsourcing e-mail is an excellent alternative for many companies, but as our reviews show, you get what you pay for, and you pay for what you get.

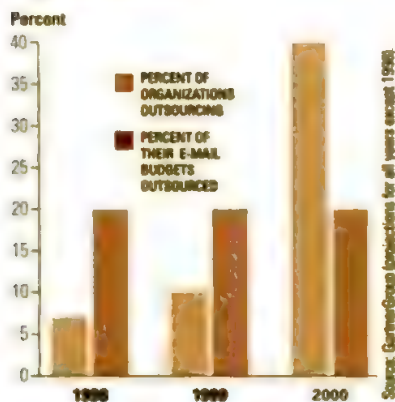
Rapid Growth

Although the portion of budgets reserved for outsourcing holds steady at 20 percent, the number of companies allocating that much to their IT budgets will increase by almost 300 percent by the end of 2000. And by 2002 \$2.5 billion will be spent on outsourcing worldwide.

Money spent on hosting systems



E-mail outsourcing in larger organizations



THE IMAP SOLUTION:

Critical Path

* We chose to test Critical Path's IMAP Service, even though the company provides POP3 as well. IMAP generally costs more but offers better mail management and off-line capabilities. With extended features such as directory synchronization, calendaring, subdomains, and multiple language support, Critical Path can take advantage of the scalability and reliability of its infrastructure to help businesses obtain e-mail systems without complex administrative hassles.

The basic IMAP service with 25MB of storage per user costs \$10 per user per month. For our tested configuration, we added SSL encryption, virus scanning, LDAP directory searching, calendaring, and directory synchronization, all totaling \$471 per month for 30 users. A \$1,000 setup fee gave us DNS changes, site branding with logos and HTML customizations, administrator training via telephone, and LDAP directory setup. (You also have to pay InterNIC \$75 for the domain name registration if you don't already own a domain.) Our dedicated support representative created our e-mail accounts, groups, and workgroup administrators. For moving a sizable mail system, Critical Path supports the Account Provisioning Protocol for automating the creation of accounts from another system.

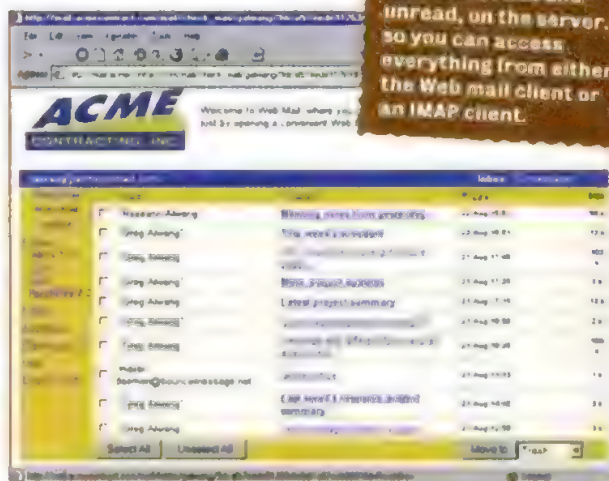
Critical Path's three-tiered administration lets you delegate mail management at the domain, company, and workgroup levels. The browser-based Mail Administration Center (MAC) lets you enable and disable services (such as virus scan-

ning or content filtering) for specific users. From the MAC you can set up unlimited subdomains (*sales.acme.com*, for example), for divisions that require branded e-mail addresses.

For ultimate e-mail control, administrators and users can enable forwarding, auto-respond, and vacation replies. Critical Path regularly e-mails reports to administrators on system uptime, outages, and the number of new and total mailboxes. Administrators also can be paged if service is interrupted.

Critical Path's Web-based e-mail client provides the basics for sending and receiving mail, but to take full advantage of what

Critical Path's IMAP option lets you keep all your mail, read and unread, on the server, so you can access everything from either the Web mail client or an IMAP client.



IMAP has to offer (such as downloading headers only and setting and utilizing message flags), you'll want a full-fledged IMAP client. The main benefit of Web-mail is that it lets you get new and old mail through any browser when you're not at your regular PC. Supporting 14 different languages, Critical Path's Web mail should appeal to multinational companies seeking an outsourcing solution. Large enterprises linking disparate systems will also welcome Critical Path's dotSync service (\$1 per user per month), which synchronizes directories and integrates e-mail systems.

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*Estimated reseller prices to end users for ThinkPad Model #2645-3AU, DC Adapter Part #02K3381, Battery Part #02K6504, Zip Drive Part #37L1504, ThinkPad Model #2611-512, Port Replicator Part #05K5591, Battery Part #02K6576, Adapter Part #11J8702. SuccessLease is offered and administered in the US and Canada by Fidelity Leasing Inc., an approved provider of business financing for IBM Global Financing. All terms are provided by Fidelity Leasing Inc.; amount of monthly lease payments based on 36-month term, full payout lease, to qualified business customers, installing in the US. A documentation fee and first month payment due at lease signing. Any taxes are additional. Other terms and financing structures are available. Offer may be withdrawn or changed without notice. Options must be leased with system unit. MHz denotes microprocessor internal clock speed; other factors may affect application performance. GB means one billion bytes when referring to hard drive capacity. Accessible capacity may vary. Variable read rate. Actual playback speed will vary and is often less than the maximum possible. These modems are designed to be capable of receiving data up to 56Kbps from a compatible service provider, and transmitting data at up to 31.2Kbps. Public networks currently limit maximum download speeds to about 53Kbps. Actual speeds depend on many factors and are often less than the maximum possible. Weight and thickness may vary due to vendor component, manufacturing process and options. All PCs in this ad ship with an operating system. All product names are registered trademarks or trademarks of International Business Machines Corporation. Intel, the Intel Inside logo and Pentium are registered trademarks and Celeron is a trademark of Intel Corporation. Microsoft and Windows are registered trademarks of Microsoft Corporation. Other company, product and service names may be trademarks or service marks of others. ©1999 IBM Corp. All rights reserved.

Canning Spam and Vanquishing Viruses

Every few hours a new computer virus is discovered, which means that viruses don't always hit the Web during business hours. Keeping your messaging virus scanner up to date requires 24-hour 7-day diligence, so why not let a service provider scan your mail for viruses; pay them to worry about the latest infections. And some service providers will also block junk mail while they're at it.

Most turnkey messaging providers offer some forms of boundary services that protect your in-box from spam, viruses, and objectionable content. Some take these services further and help you with authentication and encryption. Many of these features are part of the standard service, but the higher-end security solutions will cost you extra.

Allegro's MailZone and Electric Mail Company's E-mmunity concentrate solely on border services. Allegro customers pay a maximum of \$2 per user per month for the MailZone service, which blocks junk mail, scans for viruses, and filters objectionable content and large file attachments. The subscription includes Web-based usage and traffic reports. Most specialty services let you use your own domain name and current e-mail server. Electric Mail Company also offers a full set of messaging services.

Blocking junk mail is common practice for most complete messaging service providers. Both Critical Path and USA.net provide it free with your basic plan. USA.net both offers a global list of known spammer addresses and lets users configure their own lists. If users receive junk mail, they can forward the

messages to the USA.net administrator to add the offending address to the list. Likewise, if users send out spam, they run the risk of losing their accounts.

Allegro's MailZone uses a rated keyword system to look for

junk mail. It analyzes each message, and the more times the keywords appear, the higher its rating. MailZone does not, however, let the user request specific addresses be blocked.

MailZone provides one of the least obtrusive methods for scanning your messages. When you sign up for MailZone, the provider edits the MX (Mail Exchange) record in your DNS server to route all messages through the MailZone system on the way to your mail server. The E-mmunity service also edits the MX record, but instead of adding another IP address, it replaces your mail server's address with its own. As a result, if E-mmunity's server goes down, you won't receive e-mail.

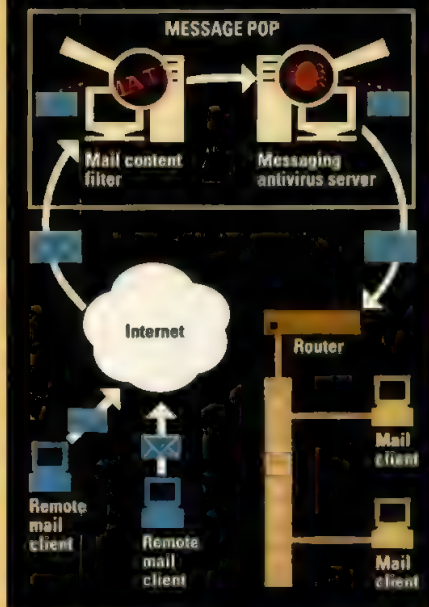
While approaching antivirus security in different ways, both E-mmunity and MailZone provide acceptable protection. Before a message reaches your mail server, it first travels through E-mmunity's virus scanner. If E-mmunity detects a virus, it destroys the virus and sends the rest of the message to you. Then E-mmunity sends a message stating a virus was found both to

you and to the administrator.

MailZone, on the other hand, deletes the entire message and sends a note alerting you that someone sent you a message with an infected attachment. This warning note also gives a link to a location on the MailZone server where the original message rests, in case you want to get it.—*Steve Rigney*

HOW IT WORKS

Boundary service providers scan your e-mail for any unwanted messages and mail-attached viruses. They use the standard off-the-shelf products to perform the scans, but they offer more frequent updates and full-time management and maintenance.



to a personal address book and address mail with nicknames, but a Company Address List will cost \$0.10 per user per month for the necessary LDAP (Lightweight Directory Access Protocol) directory service. Even then, you can't browse a list of users or easily select multiple names. Instead, you must search to find a certain address—another reason to use a standalone IMAP client. And the only way to tell if a message in your in-box has an attachment is by its size.

SSL encryption costs \$2 per user per month. For \$0.60 per user, server-based

virus scanning cleans, deletes, passes through, or quarantines infected messages. Critical Path's Professional Programming services can provide additional custom services for \$225 per hour.

For \$3 per user per month, an integrated calendar (in beta during our tests) lets you schedule events and share your agenda with other e-mail domain users. You can overlay several calendars to see color-coded events from multiple users at once and synchronize it all to a PIM. Users can also subscribe to public calendars like sports or concert schedules and

sign up for corporate events from within the calendar.

Like USA.net, Critical Path has partnered with providers in the United States and Europe, ensuring that in the case of a catastrophic failure, e-mail systems can be brought up at another data center. Critical Path offers free telephone support for e-mail administrators and round-the-clock, toll-free technical support for users.

Critical Path's IMAP Service provides both control and flexibility to administrators and users. But the price jumps as you

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One In-Box for Everything

In a perfect world we would receive our important messages on whatever device we were using at the time. We would read e-mail using our cell phones while we were traveling, and voice mail would show up in our notebooks' e-mail in-boxes. But most of us still walk around burdened with our notebooks, PDAs, cellular phones, and pagers, no matter where we are.

Nomadic users now have the ability to listen to all voice, fax, and electronic messages over the phone, and desktop users can receive the same information in their regular mailboxes. All the major carriers, including AT&T, GTE, and Sprint, offer some form of unified messaging for business customers, and they charge about \$5 a year plus 20 cents per minute. SOHO providers, such as JFax.com, offer similar features for about \$10 to \$20 a month. For businesses that want to implement their own solutions, there are several vendors, including Lucent and Nortel, that offer unified messaging products that work with existing PBXs and even groupware servers like Microsoft Exchange.

Critical Path, through its merger with dotOne, offers a unified messaging service that lets you receive faxes and telex messages right to your in-box. Another Critical Path service, which works with

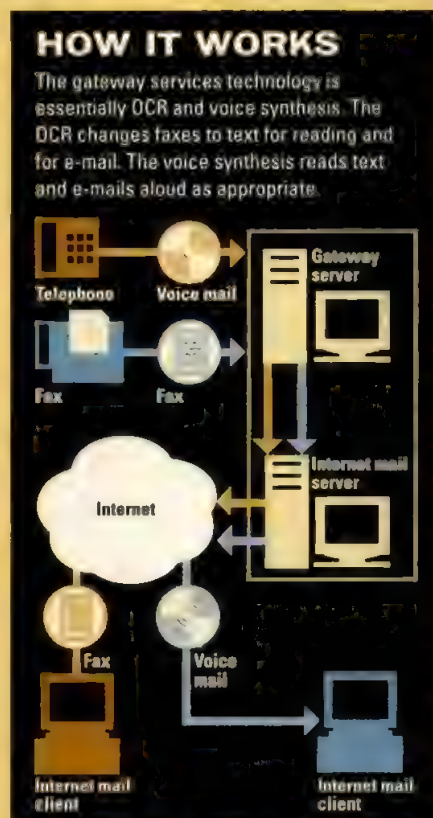
MCI and SkyTel, assigns an e-mail address to your pager. These Critical Path services are bundled upon customer re-

quest. For example, to receive faxes in your in-box you'll pay \$5 a month plus 15 cents per page. To send faxes it will cost 22 cents per message sent within the continental U.S.

AT&T offers many different services, including an EDI, Fax Service, IP Enhanced Web to Fax, and telex. When offered to existing AT&T customers, these services start around \$5 a month and enable you to send and receive faxes via your e-mail account or a via a Web page. You can schedule mass faxes, so you can send thousands of faxes at once without spending hours in front of a fax machine.

The Tornado Electronic Messaging System (TEMS) is a third-party messaging provider that you use to access voice mail, pages, e-mail, and faxes from a single Web page. Likewise, you can dial the special TEMS phone number to listen to voice mail, have your electronic messages read to you, respond to messages, and forward and route faxes. Outgoing faxes are 15 cents a minute, and incoming faxes cost 5 cents per

page. TEMS costs \$9.95 per month or \$14.94 per month with a personal 800 number.—SR



choose additional services. Nonetheless, if your e-mail needs are beyond basic, and if you don't have the in-house resources to roll out your own, consider Critical Path.—Greg Alwang

THE POP SOLUTION:

USA.net

*We chose to work with USA.net's POP3 service for this roundup, but USA.net offers an IMAP Premium Service as well. Users can access USA.net's Professional Messaging service using any POP3 or Web-mail client. For as little as \$5 per user per month, you get the equivalent of an in-house system including features such as custom folders, mail forwarding, and auto-respond. And your business will benefit from the added scalability and

fault-tolerance of USA.net's highly accessible e-mail data centers.

Around since 1991, USA.net hosts 11 million mailboxes and houses all e-mail at its data centers, which are backed by redundant server farms and environmental fail-over protection to help bring a system back up within hours. A strategic relationship with Register.com lets USA.net register your e-mail domain speedily (with Critical Path, you have to go to InterNIC yourself).

Our tested configuration of Professional Messaging included e-mail encryption and spam prevention at \$5 per user per month, for a total monthly cost of \$157.50 for our

sample 30-user company. USA.net provided us with a postmaster log-on, and we added our remaining e-mail users, who were automatically included in the Company Address Book. There is no import option for e-mail accounts, but adding users and

USA.net's professional messaging service allows e-mail aliases for routing general e-mail to specific groups of users.

Alias Name	Group Size	Actions
Account	1	Edit, Delete, Add Members, Remove Members
Admin	1	Edit, Delete, Add Members, Remove Members
Help	1	Edit, Delete, Add Members, Remove Members
Postmaster	1	Edit, Delete, Add Members, Remove Members

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Female Premiums

Age	10 YEAR	15 YEAR	20 YEAR	25 YEAR	30 YEAR
35	\$ 103	\$ 125	\$ 145	\$ 183	\$ 205
40	\$ 123	\$ 158	\$ 185	\$ 238	\$ 260
45	\$ 190	\$ 215	\$ 253	\$ 330	\$ 385
50	\$ 253	\$ 290	\$ 363	\$ 490	\$ 495
55	\$ 365	\$ 413	\$ 550	\$ 835	\$ 1,015
60	\$ 503	\$ 615	\$ 845	\$ 2,135	\$ 2,400
65	\$ 775	\$ 975	\$ 1,593	\$ 3,900	\$ 3,900
70	\$ 1,338	\$ 1,600	\$ 2,970	\$ 7,220	\$ 7,220
75	\$ 2,275	\$ 4,870	\$ 5,820	\$ 10,370	\$ 12,420

Male Premiums

Age	10 YEAR	15 YEAR	20 YEAR	25 YEAR	30 YEAR
35	\$ 123	\$ 138	\$ 165	\$ 223	\$ 253
40	\$ 148	\$ 183	\$ 225	\$ 288	\$ 335
45	\$ 225	\$ 300	\$ 380	\$ 450	\$ 513
50	\$ 338	\$ 455	\$ 525	\$ 743	\$ 828
55	\$ 500	\$ 670	\$ 788	\$ 1,640	\$ 2,330
60	\$ 783	\$ 990	\$ 1,335	\$ 3,630	\$ 3,630
65	\$ 1,330	\$ 1,650	\$ 2,693	\$ 5,250	\$ 5,250
70	\$ 2,473	\$ 3,175	\$ 4,860	\$ 8,790	\$ 8,790
75	\$ 4,400	\$ 7,443	\$ 9,600	\$ 13,260	\$ 15,030

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"Quotesmith.com provides rock-bottom quotes." - *Forbes*

"Quotesmith keeps a database of about 350 insurance companies." - *Good Housekeeping*

"Quotesmith offers particularly thorough searches." - *Los Angeles Times*

"Quotesmith will scan the insurers and provide a list of different policies suited to your needs." - *Money*

"This solution has value for those who value immediacy and privacy." - *U.S. News & World Report*

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Merging Your Mailboxes

When businesses grow and merge, so do their messaging systems. As a result, an IS department must deal with disparate systems, namely Lotus cc:Mail, Lotus Notes, Microsoft Exchange, MS Mail, and Internet e-mail. Bringing them all together is a daunting task, and many administrators don't have the expertise or time.

Most of the large consulting services, such as AT&T Messaging Services and Compaq FutureSourcing, will help you design an e-mail system using your existing disparate servers or a single standard platform; they also bundle maintenance and management. Smaller providers, such as the Electric Mail Company, offer a turnkey system, and they control and host your major gateway mail servers. Your choice of an outside service comes down to cost, how much control you want to delegate, and whether you have the space and skills to host and maintain your own messaging infrastructure.

AT&T and Compaq can provide you with direction in every aspect of your business network; messaging integration is just one area that they cover. They can help your messaging infrastructure coexist well with your network management and architecture plan. Prices vary dramatically, but you can expect to pay several thousand dollars on top of the cost of new hardware and software. Outside consultants also provide you with the option of keeping e-mail in-house, but this type of control comes at a higher

up-front installation cost.

Electric Mail Company lets you keep all of your disparate messaging servers and continue to send e-mail between them. The service starts at \$100 per month for up to 20 users within a

single post office. This includes gateway software that will run on an existing NetWare server or a dedicated PC with a runtime version of NetWare.

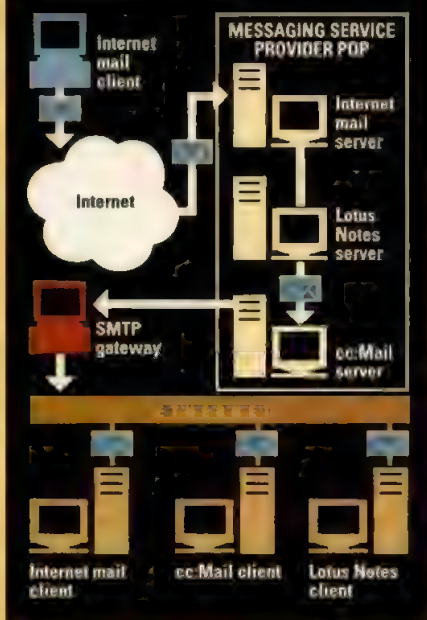
Using a service called Electric Interconnect, Electric Mail Company can integrate your cc:Mail, Exchange, GroupWise, MS Mail, Notes, and POP3 servers to send and receive e-mail. Any time you send a message from your client, the gateway routes it to the Electric Mail data center, converts it to the recipient's mail client, and sends it to the correct mailbox. The gateway connection can be a dial-up or dedicated link to any ISP, and because the service works over the Internet, you can use it from anywhere in the world. Electric Interconnect also lets you use a browser to set up users, create mail lists, and configure rules-based messaging.

Some messaging service providers may force you to switch to a standards-based solution and throw out your old proprietary messaging systems. USA.net, for example, recommends that all existing mail clients point to the USA.net SMTP Internet mail servers.

Messaging service providers usually request that you disregard your existing proprietary system and switch to an Internet e-mail standard.—SR

HOW IT WORKS

Mail integration services allow disparate platforms, such as cc:Mail, Lotus Notes, Microsoft Exchange, and Internet mail to exchange e-mail. The service requires an SMTP gateway to convert the message to a common Internet format.



creating groups was simple.

You can use USA.net's Web-mail interface or any POP3 mail client to compose or read e-mail. Though you can use dial-up connections, businesses with many users on a LAN in one location should have a dedicated Internet connection. USA.net's impressive Web client has drop-down list boxes and expanding links to help navigation and conservation of screen real estate. Almost every screen displays a Help button. Different icons indicate attachments and read and unread messages. Though you can't drag and drop messages, you can select multiple messages and click a button to move them between folders.

You can easily find an e-mail address by selecting a name from the company or personal address list, create groups in the address books, or search the LDAP directory to find people outside the address lists. You can also import to your personal address book from various PIMs.

The Web-mail client can receive and send HTML messages, but you must manually add HTML tags to change fonts, sizes, and colors. Messages can also be sent using various graphics stationery. On our tests, the return receipt option worked when sending messages to recipients who use USA.net's Web-mail client, Microsoft Outlook, or Lotus Notes. Also USA.net lets each outgoing e-mail have

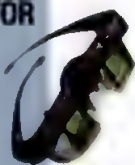
up to five attachments totaling 10MB.

A folder storage service can route incoming messages to folders based on specified criteria. A collection service will consolidate e-mail from various POP3 accounts, and a scheduling service lets you set one-time or recurring reminders to any e-mail address at a specified date and time. Users also control their own vacation replies and auto-responders. A History feature enables the administrator to view messages sent and received in the previous 14 days, including messages routed to folders or removed by the junk-mail blocker. This is an excellent way to keep tabs on spam filters.

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Other Messaging Service Providers

Besides the two MSPs we reviewed in this feature, here are others you can investigate.

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eMail
www.allegro.net
800-209-6245

AT&T
AT&T IP Services
www.ipservices.att.com
800-288-3199

Home Corporation
@work
work.hume.net
888-988-9675

CommTouch Software Inc.
CommTouch
www.commtouch.com
408-653-4330

Compaq
FutureSourcing
www.compaq.com/services
800-282-6672

Critical Path
dotOne
www.dotone.com
800-826-4666

EarthLink Network Inc.
www.earthlink.com
800-955-0186

Electric Mail Company
Electric InterConnect
www.electric.net
800-419-7443

E-Sync Networks Inc.
TotalMail
www.wihak.com
800-229-5835

GTE
Business Mail
www.gte.net
877-483-1744

HarvardNet
HarvardNet
Post Office
www.harvard.net
800-772-6771

123mail
www.123mail.net

Sprint
Sprint Mail Solutions
www.sprintbiz.com
800-810-4468

Turnado Development Inc.
(TEMS)
www.tems.com
888-275-8367

United Messaging Inc.
Internet Mail service
www.unitedmessaging.com
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anywhere on the Internet using the same branded e-mail as end users. They can customize log-on and welcome pages with colors, fonts, logos, and messages. Mail-box quotas default to 5MB but can be allocated across users at no extra cost. You can also have e-mail aliases, like info@acmecontracting.com, and route the mail to appropriate persons. Unlike Critical Path's standard 24-hour, 7-day technical support, USA.net's administrator support is available only Monday through Friday 9:00 A.M. to 8:00 P.M. Additional support is available for a per-user, per-month fee.

USA.net has a selection of premium services. For instance, it offers SSL encryption for \$0.75 per user per month; antivirus protection and pager notification are included. Missing some of the higher-end features such as directory synchronization, USA.net's Professional Messaging is still a viable and cost-effective solution for small to medium-size businesses looking to offload the expenses of purchasing and maintaining an e-mail system.—GA PC

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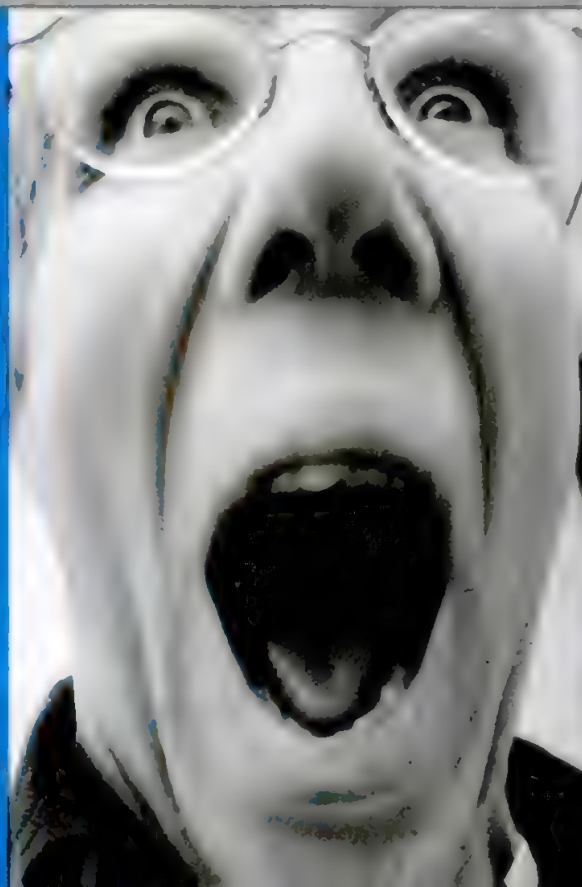
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Deskpro EP 6400	\$170.99	86.39	47.69
Presario 1255 Laptop	\$197.99	80.99	42.29
Micron Electronics			
Millennia 450	\$170.99	86.39	47.69
Millennia MME P200	\$161.99	80.99	44.09
ClientPro VXE 200/233	\$170.99	86.39	47.69
TransPort Trek2 Series	\$197.99	80.99	42.29
Gateway			
G6-300	\$161.99	80.99	44.09
P5-200	—	152.99	68.39
GP6-300	\$161.99	80.99	44.09
IBM			
Activa (2140)	\$161.99	80.99	44.09
PC 300GL (6591)	\$161.99	80.99	44.09
PC 300PL (6892-50U)	\$170.99	86.39	47.69
HP			
Pavilion 8370	\$170.99	86.39	47.69
BRIO 8338	—	80.99	44.09
Vectra VL Series 8	\$170.99	86.39	47.69
Apple			
iMac	\$197.99	80.99	42.29
Power Mac G500 Series	—	161.99	89.09
Power Mac G3	\$165.59	80.99	44.09
Power Mac G3 PC100	\$170.99	86.39	47.69

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Outsourcing is a good idea, but there are lots of reasons to host your own e-mail.

By Les Freed

Our story on outsourcing your e-mail makes a compelling argument for handing your e-mail headaches over to someone else. But as we point out, there are still several good reasons for doing it yourself. Some of these reasons are technical, but the issue mostly has to do with your comfort level. If your organization, like many in the Internet era, lives and breathes via e-mail, you may not be comfortable letting someone else handle it. This is especially true if you have the resources—specifically the hardware, Internet connection, and, most important, the staff—to do the job yourself.

Moving your e-mail off-site requires you to place a great deal of trust in your outsourcing vendor. Most messaging service providers (MSPs) offer service guarantees, but those are of little consolation if your company loses revenue because of an e-mail problem. Security-conscious companies may worry about putting their sensitive e-mail data on someone else's server. Your mail data should be equally secure on your server or an MSP's, but you may sleep better knowing that your data is under your own roof.

You may still lose some sleep now and then, dealing with system crashes and other maintenance problems that inevitably affect every system. If you're prepared to keep your e-mail in-house, you should also be prepared to provide support personnel to keep the system running. Hosting your own mail server may also save you money in the long run, but you'll need to absorb some costs up front. Outsourcing lets you put the initial capital burden on the MSP, but that monthly bill will keep coming.

However you decide, in-house or outsource, the most important decision you'll make is choosing between an e-mail server and a groupware package. For this roundup, we focused on products suitable for 50 to 250 users and assembled seven e-mail servers: CommuniGate Pro, Eudora WorldMail Server, IMail Server



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5.0, Infinite InterChange, IntraStore Server 2000, MailSite 3.0, and NTMail (Netscape Messaging Server 4.1 was not ready for us to test in this roundup). We also reviewed the top three groupware packages: Domino R5 Server and Lotus Notes R5, Groupwise 5.5, and Microsoft Exchange Server.

Thanks to the Internet Message Access Protocol (IMAP) Version 4, e-mail servers now provide many of the message-organization and replication features formerly found only in the more expensive groupware packages. Although IMAP is considered an Internet protocol, it provides the robustness necessary for corporate mail, even if you rarely send messages outside your company.

Unlike the simpler and more common POP3 mail servers provided by most Internet service providers, IMAP servers let users maintain copies of their messages on their PCs and on the server. Each message remains on the server until the user deletes it. In addition, IMAP users can organize messages into folders, making mailbox management easier. And unlike POP3, the IMAP protocol supports synchronization, so users can take their mail messages off-line and then upload changes the next time they connect.

The IMAP servers in our roundup cover a lot of ground, in terms of both price and features. Because they all support the same IMAP standard, they look alike from the client end of the connection. But the differences in OS integration, configurability, and manageability are clear from the administrator's seat.

Groupware packages offer much more than e-mail, but are also more expensive to install. The groupware packages in our roundup all provide group scheduling, contact management, threaded discussion, and extensive document-

EDITORS' CHOICE

- E-mail servers: NTMail
- Groupware: Domino R5 Server and Lotus Notes R5



package that integrates scheduling, discussions and document management. Consider both your current and future needs.

If you choose to go with a straight mail server, then we recommend Gordano's NTMail. NTMail offers a great set of features and won us over with the best Web administration interface in the roundup. NTMail also features an spam and security capabilities as well as great integration with Windows NT's system-monitoring services.

Should you decide groupware best suits you, it's hard to go wrong with any of the packages we review. But

Once you've decided to host your own messaging system, the next decision you'll need to make is whether to go with a mail-only solution or a with a groupware

our nod, once again, goes to Lotus's Domino R5 Server and Notes R5. Domino impressed us with its improved installation program and management interface—the best we saw. This package also shows off the long-awaited revamped Notes client, which adds support for IMAP4 and POP3 mail servers.

Novell's GroupWise 5.5 and Microsoft Exchange Server remain strong competitors to Domino. We eagerly await the next release of Exchange, code-named Platinum, which is due shortly after Windows 2000 ships. This new version will integrate tightly with the pending OS's new directory service.

sharing features. Each provides a development platform that lets you write your own custom applications to extend the package's basic functions.

By streamlining communications and encouraging collaborative work, a groupware system can change the way your company does business. On the downside, groupware packages are inherently more complex than e-mail servers, and therefore take longer for both system administrators and end users to master.

The line between e-mail and groupware becomes more blurred as e-mail vendors add new features to their products. Several of the IMAP servers in our roundup include NNTP discussion servers, enabling those servers to provide groupwarelike discussion features in addition to basic e-mail services. Many IMAP e-mail clients (including Microsoft Outlook, Outlook Express, and Netscape Communicator) include NNTP clients, so your users can access e-mail and discussion groups with a single client software package.

It's possible to add other groupware-like features to your network without purchasing a groupware package. You can start with an IMAP and NNTP server and then add third-party calendar, document-sharing, and application servers as your needs grow. If you go this route, it's unlikely that the modules will integrate as neatly as with groupware, and your deployment, training, and support costs will likely rise substantially.

Many organizations choose a groupware package based on their existing network infrastructure, and especially the network user directory. Not surprisingly, Novell's GroupWise 5.5 and Microsoft Exchange are tightly integrated into their companies' respective network directory environments. GroupWise obtains its user directory from Novell's NDS directory system, and Exchange uses Microsoft Windows NT domain security.

To stay competitive, Lotus has also tightly integrated its directory with Windows NT. Integration reduces the effort of managing separate LAN user and

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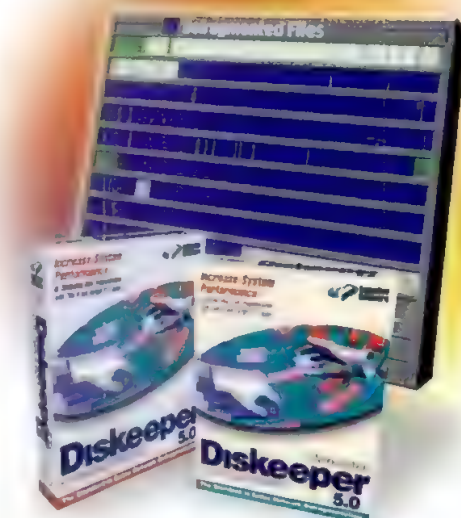
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INTERNET SERVICE

e-mail user databases. As your messaging system grows in size and complexity, the greater manageability of a groupware package may actually reduce the difference in cost between it and an IMAP server.

Ultimately, your decision between IMAP and groupware may come down to a matter of style and corporate culture. Groupware products really shine in environments where there is a great deal of interaction and collaboration among employees. It's even more effective when those employees are spread among several business locations, or if a large number of employees work from home or travel.

Finally, keep in mind that you can have it both ways. All three of the groupware products in our roundup support Internet standards and provide excellent IMAP and Web access to user mailboxes. This lets you install a groupware server and expose the package's more advanced functions as demand warrants.



Our test-bed consisted of 400-MHz Pentium II PCs, each with 128MB of RAM, connected via shared 100Base-TX, and running Microsoft Windows NT Server, Service Pack 3 (unless the product required otherwise).

To test **deployment**, we install each server on a test PC and configure it to work with our network infrastructure. Success depends on the ability to send and receive messages between local network

clients and remote e-mail systems. To test **management**, we use each product's tools to perform ongoing administrative tasks, such as modifying users, monitoring and tuning servers, and configuring alerts.

We test **user tools** with all proprietary client software, Web interfaces, and third-party clients like Outlook Express. To rate **security**, we check for spam filtering, antivirus protection, and Web interfaces with SSL. We also look for authentication methods, NT SAM, LDAP directories, proprietary databases, APOP protocol, and protection against SMTP relays.

	Deployment	Management	User tools	Security
E-MAIL SERVERS				
CommuniGate Pro	Fair	Good	Good	Excellent
Eudora WorldMail Server	Good	Fair	Fair	Fair
IMail Server 5.0	Good	Good	Good	Good
Infinite InterChange	Good	Fair	Good	Good
IntraStore Server 2000	Poor	Good	Fair	Good
MailSite 3.0	Excellent	Excellent	Fair	Good
Internet* copies NTMail	Excellent	Excellent	Good	Good
GROUPWARE				
Internet* copies Domino R5 Server and Notes R5	Excellent	Excellent	Good	Excellent
Microsoft Exchange Server	Excellent	Good	Good	Excellent
GroupWise 5.5	Good	Good	Excellent	Good



e-mail servers

CommuniGate Pro

50 users, \$499 list. Stalker Software Inc., Mill Valley, CA; 800-262-4722, 415-383-7164; www.stalker.com.

●Targeted at midsize businesses, Stalker Software's CommuniGate Pro provides ample messaging capabilities, security, Web administration options, and multi-platform support. CommuniGate Pro would benefit from an improved user interface and an adherence to standard Windows conventions, but it does support more OS platforms than any other product in this roundup.

The installation process could use improvement. An installer applet copies files to the hard disk, but it doesn't add menu options to the Program Files directory. When we referred to the read-me file, we found out that in order to log on to the server via a browser, we needed to track down a special file containing a

randomly generated password.

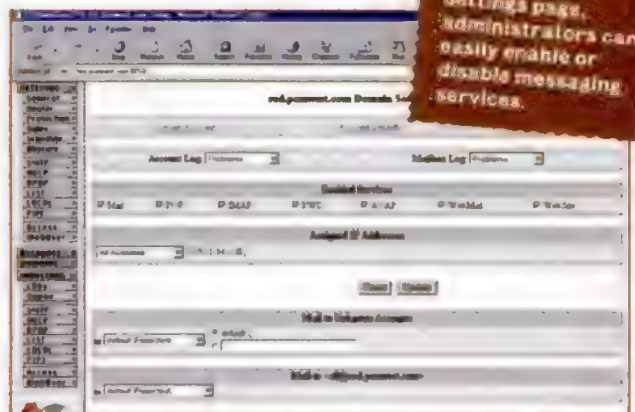
CommuniGate Pro's Web console's user interface needs refining as well. It doesn't provide a Windows-based administrative utility; rather it is fully maintained from the Web console, which has a host of configuration options. Several of these options have Update buttons, but the program does not let you know when changes have gone into effect.

Unlike IMail Server 5.0, MailSite 3.0, and NTMail, CommuniGate Pro cannot directly import Windows NT user accounts. Administrators can, however, import user data from a text file, and use over 40 commands for scripting

and automation purposes. All end-user account administration is completed with a browser. The included Web client gives users control over a variety of settings, such as changing passwords, configuring auto-reply, and redirecting mail.

CommuniGate Pro has good security and antis spam options. It can block spam by IP address, e-mail address, and domain name. Administrators can specify that only trusted IP addresses can configure the server, automatically denying other IP addresses access. To prevent snooping, all administrative com-

At the Domain Settings page, administrators can easily enable or disable messaging services.



SUMMARY OF FEATURES

See www.pcmag.com for interactive views

E-Mail Servers

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	CommuniGate Pro	Eudora WorldMail Server	IMail Server 5.0	Infinite InterChange	IntraStore Server 2000	MailSite 3.0	NTMail
☒ YES ☐ NO							
List Price	\$499 (50 users)	\$159 (10 users)	\$995 (250 users)	\$999 (50 users)	\$4,000 (50 users)	\$495 (100 users)	\$495 (50 users)
Supports Windows NT / Solaris	☒	☒	☒	☒	☒	☒	☒
Other platforms supported	AIX, D/Unix, FreeBSD, HP/UX, IRIX, Linux, MacOS X Server	None	None	Windows 95, 98	AIX, HP-UX, Linux	Windows 95, 98, 2000	Linux
IMAP4 clients bundled							
Windows 3.x / 95 / NT	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☒ ☒ ☒	Optional Optional	☐ ☐ ☐	☐ ☐
Macintosh/Unix	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐
Remote install/User-list import from OS	☐ ☒ (add-on)	☐ ☐	☐ ☐	☐ ☒ Win NT, NetWare NDS only)	☐ ☐	☒ ☒	☐ ☒ Win NT only)
IMAP4 FEATURES							
Supports off-line/online/disconnected access	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒
Supports multiple/hierarchical folders	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒
Supports shared address book/folders	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒
Supports IMAP4 and POP3 on the same server	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒
Uses SMTP pipelining	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☐ ☐ ☐	☒ ☒ ☒
Includes LDAP directory server	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☐ ☐ ☐
MANAGEMENT							
Administration via GUI/command line/HTML interface	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒
Administrator can							
Administer multiple servers centrally	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒
Administer multiple domains/access remotely	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒
Monitor performance and status	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒
Administer user accounts by user/domain/server	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒
Restrict user by mailbox size/access time	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒
Restrict user by incoming message size/number of messages	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒
Provides delivery status (ESMTP)	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒
User address book on server (IMSPV/Automatic directory update)	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒
SECURITY AUTHENTICATION							
SSL/Qualcomm password server	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒
CRAM MD5 / APOP / X.509	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒
Kerberos/Plain text/Windows NT Domain	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒
Other antispam features	Blacklist, IP range restrictions, multiple real time blacklists (RBLs), remote authentication	IP range restrictions	SMTP authentication, relay, local relay host, user - P	Blacklist, open relay restriction	RFC2505 antispam for SMTP, RFC2504, SMTP authentication	Blacklist, SMTP authentication, reverse DNS, SPF, DKIM, etc.	Win NT), JUCE, filters, multiple RBLs
PROTOCOLS SUPPORTED ON SERVER							
IMAP4 RFC 1730 / RFC 2060	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒
MIME / POP3	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒
SMTP/Finger/LDAP	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒	☒ ☒ ☒
X.400 / X.500	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	Optional ☒	☐ ☐ ☐	☐ ☐ ☐
Gateways included							
Lotus cc:Mail/Lotus Notes	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☒ ☒ ☒	Optional ☐ Optional ☐	☐ ☐ ☐	☐ ☐ ☐
Microsoft Exchange/Microsoft Mail	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☒ ☒ ☒	Optional ☐ Optional ☐	☐ ☐ ☐	☐ ☐ ☐

munication with the server travels over secure connections.

CommuniGate Pro has all the elements of a good e-mail server, with robust security, excellent platform support, and powerful administrative tools. When Stalker designs a more refined user interface, CommuniGate Pro will become a contender in the e-mail server market.—*Rob Schenk*

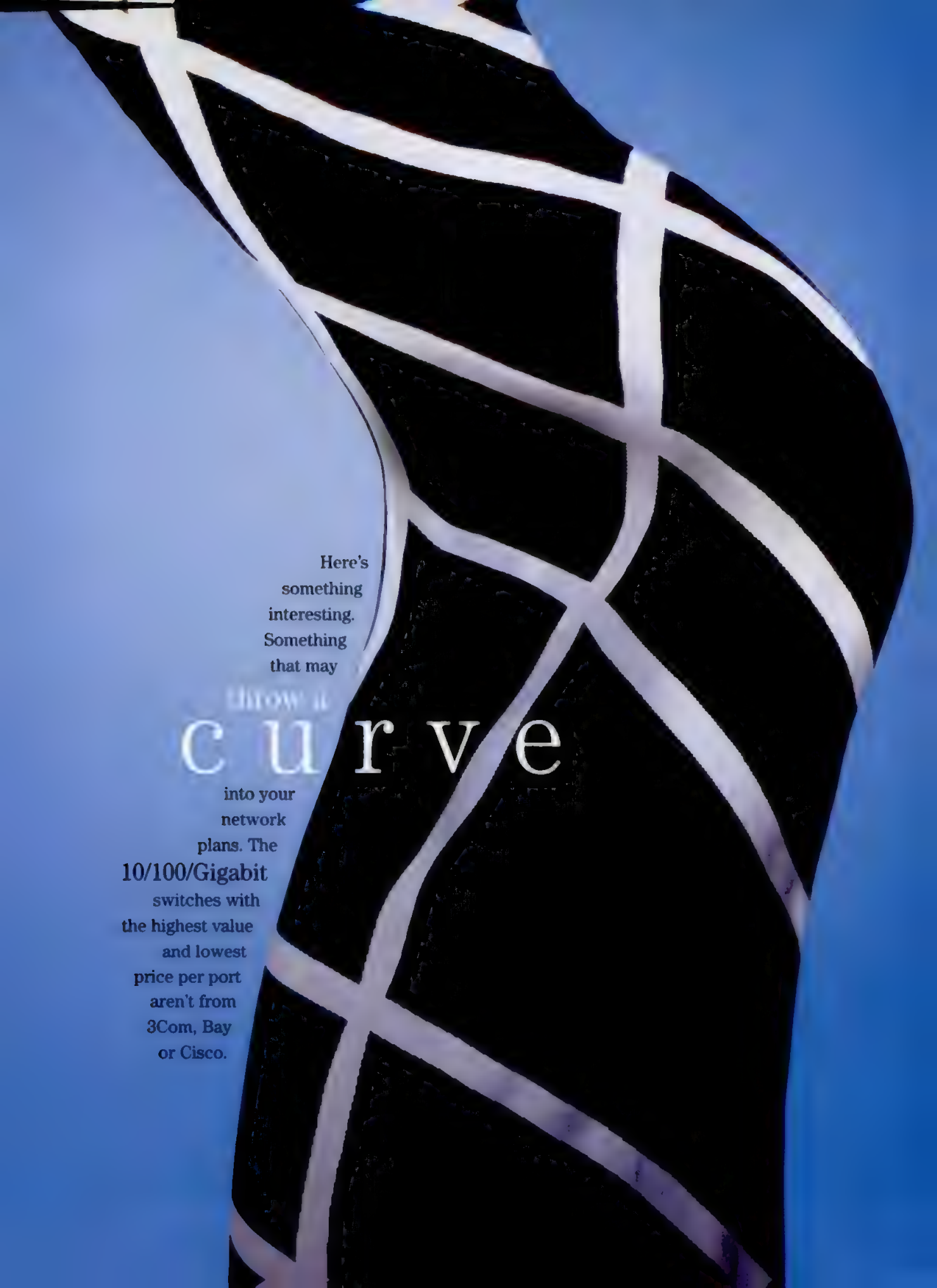
Eudora WorldMail Server

10 users, \$159 list. Qualcomm Inc., San Diego, 800-544-4977, 619-587-1121, www.eudora.com

● In our previous reviews of Qualcomm's Eudora WorldMail server, we liked its ease of administration and POP messaging capabilities. Without any significant revisions to its feature set over the last two years, however, WorldMail pales in

comparison with the other products in this roundup. Its low price and limited scalability makes WorldMail best for small businesses.

Installation of WorldMail was easy enough. We created a mail domain and populated the user database. Qualcomm provides a migration utility for Lotus cc:Mail user accounts, but it didn't have a tool for importing Windows NT users and



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interesting.
Something
that may

throw it
c u r v e

into your
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plans. The
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switches with
the highest value
and lowest
price per port
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switches give you more
for your money.
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All ports autosensing.
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All at a price per port up
to 50% less than other
major network companies.

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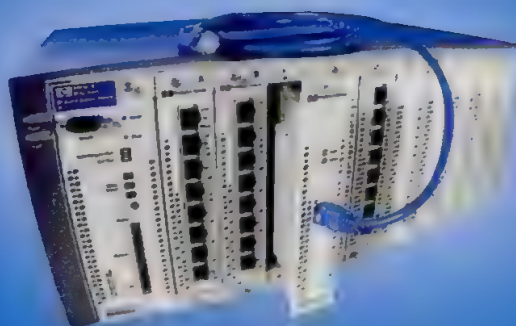
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HP ProCurve 4000M \$89 per port
3Com SuperStack II 3300 \$156 per port
Bay Networks 450T \$173 per port
Cisco 3524XL \$156 per port
72-port configuration list prices



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E-Mail Appliances

Small businesses choosing between deploying their own e-mail infrastructures and outsourcing may find a purchasing sweet spot with an appliance server. Designed to serve between 5 and 50 users, these products don't have the performance, fault tolerance, or scalability of an in-house solution or hosting provider, but they are affordable, simple solutions.

The new Eilink EIS server (free with a 15-month commitment to UUnet's \$99-per-month Internet service) has built-in networking, an OS, proxy caching, and Web and e-mail services, with all the complexity hidden behind a browser interface. To test the Linux-based EIS, we set up a small Windows 95, 98, and NT Workstation network and had the 333-MHz Celeron server delivered and installed; it was operational within 30 minutes.

The server's DHCP capabilities doled out IP addresses to our PCs, and the interface for setting up network and e-mail accounts was simple and straightforward. Eilink provides a second modem for dial-in support and remote access. It also offers printer and file sharing, a backup utility, and a simple packet-filtering firewall. (Eilink Corp., Fremont, CA; 510-857-8292; www.eilink.com.)

The Intel InBusiness eMail Station (\$680 street) and Technaunts eServer.mail (\$700 street) are aimed at businesses that already have networking infrastructure or are only interested in solving their Internet mail issue. Both ably handle e-mail, though we give a slight edge to the eServer.mail for features and management. Both were simple to set up, but the eServer

.mail gathered addressing parameters that the eMail Station requires you to add manually. We set up the servers on our network within 45 minutes and sent mail internally and externally without a problem.

Both servers allow you to start with an external modem and scale up to send mail through a router. These solutions embrace SMTP and POP3 standards, but not IMAP4. They cover the features gamut by including the ability to add and delete users;

create groups, auto-reply messages, and mailing lists; and forward mail.

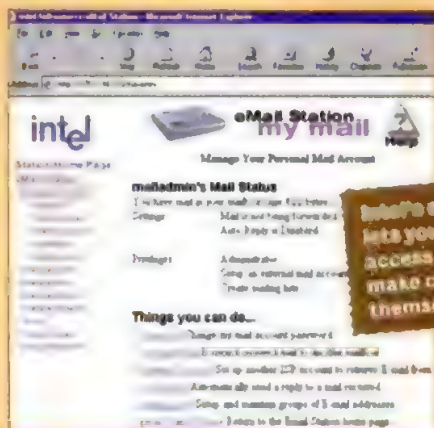
The eServer.mail and the eMail Station can consolidate mail for users with multiple accounts (the eServer.mail can handle three and the eMail Station one additional address). They also let you limit mail files' disk space and schedule mail retrieval.

Both have backup utilities.

Unlike the eMail Station, the eServer.mail keeps drill-down lists on user space usage and sends e-mailed maintenance

alerts; it also has more thorough logging.

Both servers let you set up and maintain user mailboxes or have them hosted by an ISP. We liked the fact that the eServer.mail isn't dependent on the ISP to route internal mail and process external mail, decreasing traffic. Additionally, while each server offers over 2GB of disk space, the eServer.mail is more efficient in storing a broadcast e-mail attachment only once. (Intel Corp., Santa Clara, CA; 800-828-8686; www.intel.com. Technaunts Inc., Cary, NC; 877-373-7837; www.technaunts.com.)—Jeffrey G. Witt

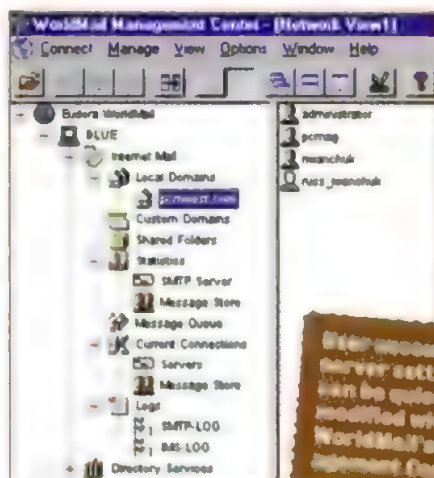


groups. Qualcomm does include a command line utility to import user information from a text file.

The Web administration interface doesn't measure up to those of IMail Server 5.0, MailSite 3.0, and NTMail. The Windows-based WorldMail Management Center console can quickly configure user account information and mailing lists. You can grant specific privileges to Web administrators, such as enabling disk quotas or modifying mailing-list members, thus establishing various levels of access. Although the administration utility is useful, it lacks substantial security options and spam blocking. Users have limited control over their accounts; they can only change passwords or configure auto-replies.

WorldMail has an SMTP mail server, an integrated POP/IMAP4 message store,

Internet Directory with LDAP and Internet White Pages protocol, and a Web/Directory Gateway. But it doesn't let you access e-mail via a browser. Users can



also subscribe or unsubscribe to mailing lists by sending e-mail to the built-in list server. An LDAP directory server enables storage of user names and e-mail addresses in a central repository.

WorldMail provides adequate logging and monitoring abilities. Administrators can supervise the e-mail queue and see POP3, IMAP, and SMTP transactions in real time. WorldMail adds counters to Windows NT's Performance Monitor, which enables monitoring of e-mail-specific services. But there are no advanced alerting mechanisms like paging or e-mail.

Administrators can use another Windows NT Workstation or Server to manage WorldMail remotely over the LAN. Security consists of a combination of SMTP relay, multiple-level access control, and APOP

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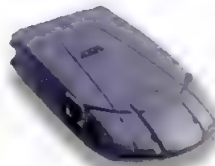


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authentication. Eudora WorldMail falls behind the competition, but it may work for budget-minded small businesses that need simple messaging capabilities without much scalability or security.—RS

IMail Server 5.0

250 users, \$995 list. Ipswitch Inc., Lexington, MA; 781-676-5700; www.ipswitch.com.

● Ipswitch's IMail Server 5.0 offers a lot of bang for the buck. It supplies a wide range of messaging capabilities and administrative tools at an attractive price.

During the straightforward setup process, you have the option of specifying the authentication method for each domain host. If you choose the Windows NT database, you'll need to install IMail on a Backup Domain Controller. IMail will then add new users through Windows NT's User Manager.

IMail offers a collection of Windows-based applets that control various aspects of the server. It would be more efficient if they existed in a single application, as with MailSite 3.0 and NTMail. Using a Control Panel applet or the Web interface, you can configure automated rules on a per-user, per-domain, and per-server basis.

Like MailSite and NTMail, IMail can directly import Windows NT user account information. Command line utilities add large groups of users, delete mail by date, and stop or start selected services. Administrators can modify the Web mail interface by adding custom graphics and text. You can assign an administrator the rights to maintain a particular domain with its own set of Web host files. Thus each domain can have its own specific interface.

Users access e-mail with any Web-browser or POP3 or IMAP client. Using

the Web interface or the Windows client, you can move, delete, forward, or answer e-mail. But Ipswitch doesn't link the address book feature of IMail's Web interface to the LDAP directory. As a result, you must maintain a separate address list or a full-featured LDAP client. IMail provides mailing list support, letting users subscribe to lists with an e-mail message. Users can modify directory information using the Web interface, and query the database.

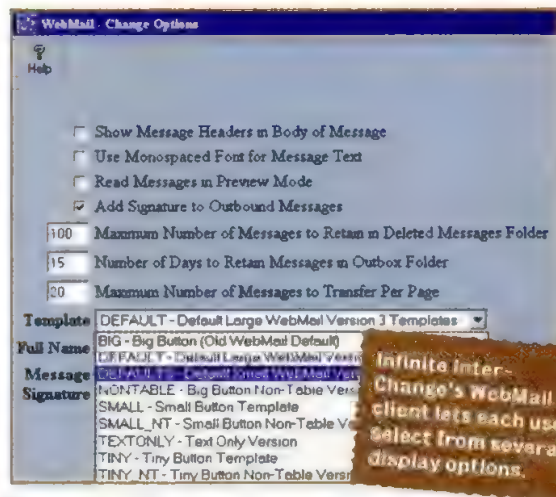
Administrators can filter domains by IP address, name, and e-mail address. You can enable SMTP mail relay for local hosts or local users, or deny them altogether. Using the IMail Monitor server applet, administrators can supervise disk usage and IP services on the server, including SMTP, DNS, and POP activities. In case of a system outage, administrators can configure the applet to alert them via e-mail or pager. Unlike MailSite, Eudora WorldMail Server, and NTMail, IMail has no integration with Windows NT's Performance Monitor. This means you must rely on IMail's log, which lacks an analyzer.

We'd like to see better monitoring integration with Windows NT, along with a more evolved end-user Web interface. These quibbles aside, IMail provides a solid foundation for the messaging needs of small and medium-size businesses.—RS

Infinite InterChange

50 users, \$999 list. Infinite Technologies, Owings Mills, MD; 800-678-1097, 410-363-1097; www.ihub.com.

● Infinite InterChange combines a mail server, Web server, and Web e-mail gateway system into one package. When used as a standalone server, Infinite InterChange provides basic POP3, IMAP4, and SMTP services with Web access from user mailboxes. It can act as a Web-based gateway to a variety of other e-mail systems, including POP3, IMAP, Lotus cc:Mail, and Microsoft Exchange systems. Infinite Inter-



Infinite Inter-Change's WebMail client lets each user select from several display options.

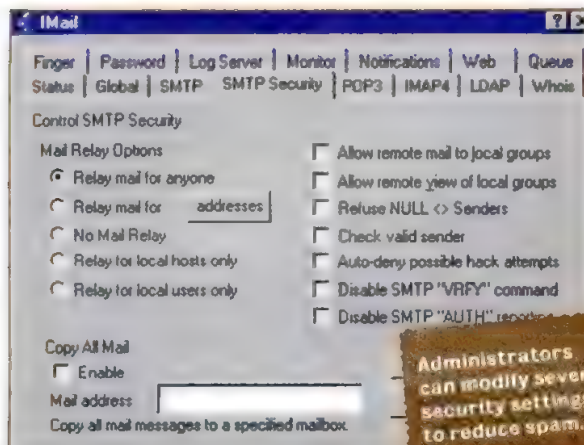
Change's comprehensive Web interface is user-customizable and includes a spell-checker and online address book. Unfortunately, it doesn't include a Web administration interface.

Unlike many of the products in our roundup, Infinite InterChange doesn't require a server-based operating system; it runs on Windows 95, 98, or NT. Installation takes only about 10 minutes, and a configuration wizard walks you through the basic setup steps. Infinite InterChange can import user database information from a Windows NT domain or from NetWare Bindery or NetWare NDS server.

InterChange has a straightforward management interface and provides excellent real-time monitoring of user log-ons and message traffic. The lack of a Web administration interface means that all administration tasks must be accomplished directly on the server. Infinite InterChange supports the LDAP directory protocol. SSL security costs \$1,000 for 50 users.

Unique among the products in our roundup, InterChange can function as a standalone mail server and as a gateway to one or more external mail servers. Each user account can refer to one or more external mail accounts. When a user connects to the Infinite InterChange server, the server automatically connects to the user's external mail server and transfers new messages into the Infinite InterChange mailbox. This lets users consolidate e-mail from several accounts. It also provides a Web interface for POP, IMAP, and other mail systems that don't normally provide one.

Infinite InterChange's impressive



Administrators can modify several security settings to reduce spam.

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If you're willing to forgo the bells and whistles of the e-mail servers in our roundup, consider a functional freeware solution, which can be had for the cost of the hardware. Keep in mind that going the freeware route requires considerable expertise, and if you don't already have the necessary knowledge, the time you'll invest may outweigh the initial savings.

We looked for a free e-mail IMAP solution for about 250 users. Instead of Windows NT Server (which costs \$800 with five user licenses) as our operating system, we installed Red Hat Linux 6.0 (\$75 list, but you can also download Linux free at www.redhat.com). The e-mail servers in the roundup package MTA, IMAP, POP services, and a Web interface. But freeware e-mail services are separate products, each with its own installation procedure.

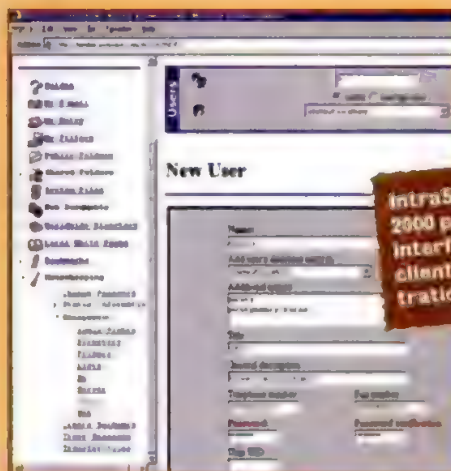
An MTA provides the core functionality by storing incoming messages and sending and receiving mail. On one server we used the free **qmail** (www.qmail.org), which is easier to configure and is reportedly more secure than the popular Sendmail. We also added free IMAP functionality from the University of Washington

(www.washington.edu/imap). On another server we installed Control Data Systems' free Linux version of **IntraStore Server 2000** (see the review of the Windows NT version in this story), which gave our configuration a Web interface as well as the IMAP and MTA functionality.

Between qmail's extremely thorough help files and the wealth of online resources, its installation is well documented. The basic procedure is to

unpack the distribution, create the qmail users and groups, compile the distribution, and start the service. There are extensive options for tweaking

qmail, but you don't need to do much for a basic installation. Installing UW's IMAP server was a similar procedure (download, configure, compile, start services), but you have to customize the



installation to work with qmail.

Also, IntraStore is easy to install and use. Simply run the installation (accepting defaults with few exceptions) and compile. It has X.500 directory integration and a fully functional Web interface for administration and e-mail access. —Russ Iwanchuk

rules-based message processing lets the administrator (but not the end user) create processing rules that automatically apply to incoming messages and help filter spam. You can use rules to watch for specific senders, recipients, or phrases.

Finally, Infinite InterChange includes an NNTP discussion server. Like the mail server, the NNTP server can automatically download content from an external NNTP server. This lets you host your own private discussions while providing access to selected Usenet or other public discussions from an external server. —LF

IntraStore Server 2000

50 users, \$4,000 list. Control Data Systems Inc., Arden Hills, MN; 888-742-5864, 651-415-4401; www.cdc.com.

● Control Data Systems' IntraStore Server 2000 targets ISPs, large global corporations, and now midsize businesses. IntraStore has adequate administrative tools, but a difficult installation and high cost; other products here offer better value.

We found the installation unnecessarily complicated. We first needed to grant the administrator account advanced user

privilege from within User Manager for Domains. Control Data also requires that you send it the MAC address of your Ethernet adapter to generate a license key.

We copied the files to the hard disk and launched the Messaging Administrator, but several necessary services did not start. To remedy the problem, we needed to launch a setup wizard that configured e-mail-domain and X.500 information. We'd like to see the two installation procedures combined into a single process.

IntraStore provides a good range of security and antispam capabilities. IntraStore can block mail from a particular domain, IP address, or individual e-mail addresses. You can also limit the number of connections an originating system can make with the server.

As with CommuniGate Pro, the vast majority of IntraStore's management tasks are completed via the Web interface. Although less feature-rich than NTMail, IntraStore also includes a client Web application for checking e-mail. Users can create folders and filters, delete

messages, and search for text strings in specific fields. Creating auto-replies and vacation messages is not as easy as with MailSite: You must configure these options using filtering rules.

Monitoring and logging are among IntraStore's strengths. Through the Web interface, you can schedule status reporting for particular days, hours, or specific time intervals. The software can then automatically create reports. Administrators can monitor disk quota and disk usage, broken down by user name. SNMP support is also built into the product.

Unlike IMail, MailSite, and NTMail, IntraStore cannot import Windows NT user accounts (migration tools are available for an additional charge). No counters are added to Windows NT's Performance Monitor, but a few critical system events can be logged to Windows NT's Event Viewer.

IntraStore would benefit from a simplified installation and better integration with Windows NT. Considering IntraStore's high price, we see better value in other products in this roundup. —RS

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E-Mail Servers & Groupware

MailSite 3.0

100 users, \$495 list. Rockliffe Systems Inc., San Jose, CA; 408-554-0766; www.rockliffe.com.

● Rockliffe Systems' MailSite 3.0 provides smooth installation coupled with strong administrative tools, acceptable messaging and mailing list capabilities. Considering its reasonable price, we think MailSite is worth a serious look.

We had the MailSite software installed and configured within a few minutes. Like IMail Server 5.0 and NTMail, the software imported our existing Windows NT users into MailSite's user database. MailSite integrates with any ODBC-compliant database and can be used to store mailing-list membership and logging information.

MailSite consists of several services, including SMTP, POP3, IMAP, LDAP, HTTP management, and Eudora Change Password. You can manage the software in several ways: using the Windows console, an HTML Web interface, or a Java-based administrative interface. These let you adjust mailbox quotas and warning levels as well as manage user mailboxes or mailing lists. You can modify the Web console by manipulating the template files that Rockliffe provides.

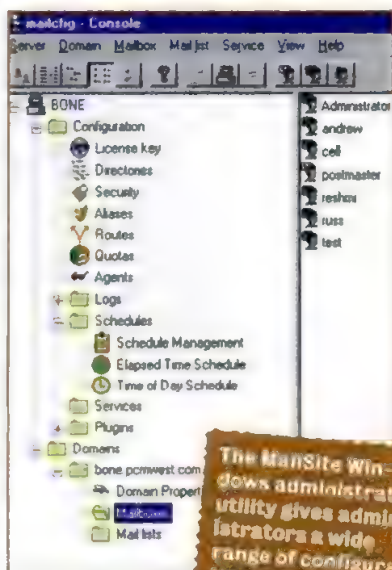
Users can be assigned one of three privilege levels: none, domain, or server (the most powerful). Users with no privileges are able to connect to the server via a browser and can manipulate their personal mailbox settings. Administrators with domain privileges can modify user accounts in their own domain, and administrators with server privileges can make changes in all domains. In this release of MailSite, however, users cannot check their e-mail via browser (the feature should be available by the time you read this). MailSite offers a wide variety of security and antispam capabilities. As with CommuniGate Pro, IMail, and NTMail, you can reject incoming mail by domain name, IP address, or spe-

cific e-mail address. SMTP relay and SMTP authentication processes can also help reduce spam.

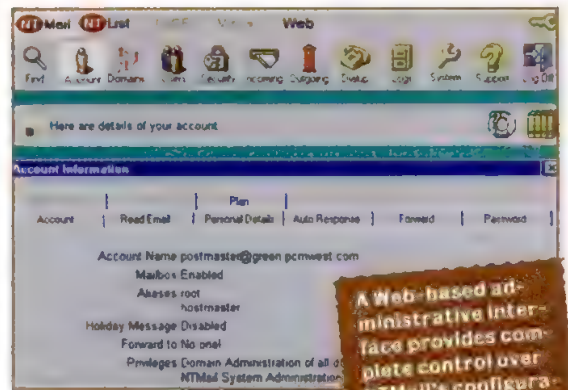
MailSite integrates well with Windows NT's Performance Monitor. Seven counters are installed with the product, enabling administrators to monitor e-mail activity. Critical system events are tracked with Windows NT's Event Viewer and can be logged to an ODBC-compliant database. MailSite, like CommuniGate Pro, Eudora WorldMail Server, and IntraStore Server 2000, can also track events in real time through the Performance Monitor and built-in logging feature.

A set of command line utilities can be used to save and restore your MailSite configuration, manage aliases and mailing lists, and create large numbers of user accounts quickly. The server can be administered from any Windows 95 or 98 machine.

With strong security features and administration tools, MailSite provides robust function at a reasonable price.—RS



The MailSite Windows administrative utility gives administrators a wide range of configuration options.



A Web-based administrative interface provides complete control over NTMail's configuration settings.

allows user account authentication with an ODBC-compliant database.

The feature-rich and easy-to-navigate Web administrative interface is a standout in this roundup. The Java-based applet has context-sensitive help and a cleanly designed toolbarlike interface. NTMail server functions are clearly delineated; we had no problem configuring lower-level server settings.

End users can use a standard browser to access their e-mail; they can read, forward, reply, and delete mail, but the Web interface lacks filtering and address book capabilities. The next version of the Web interface (which should be available by the time you read this) promises these features.

NTMail offers good security and antispam capabilities. Administrators can blacklist domains by IP address and domain name. As with IntraStore, you can allow only a certain number of connections from a specific address, which reduces the possibility of denial attacks. Users can subscribe to a mailing list with an e-mail, but the list server is limited to 250 users.

NTMail offers strong integration with Windows NT's System Monitor services. Like Eudora WorldMail Server and MailSite 3.0, NTMail adds several performance counters to Windows NT's Performance Monitor. Critical system events are noted in Windows NT's Event Viewer. If a service fails, NTMail logs the event and restarts the service automatically. NTMail can't log events to an ODBC database.

With an outstanding Web interface, fine Windows NT integration, and a powerful feature set, NTMail stands out in this roundup. With an enhanced end-user Web interface and load-balancing capabilities in the wings, NTMail deserves to be on your short list.—RS

NTMail

50 users, \$495 list. Gordano Ltd., North Somerset, England; 877-292-1142; www.gordano.com.



A well-designed Web interface coupled with strong security and Windows NT integration earns Gordano's NTMail our Editors' Choice. The product's ease of use and feature-rich capabilities make it a natural fit for ISPs and small to midsize businesses.

By following a wizard-based installation routine, we had NTMail configured and working in a few minutes and we were able to import Windows NT user accounts quickly. The software also

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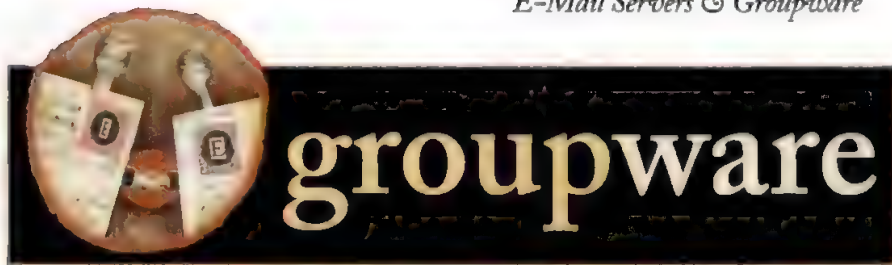
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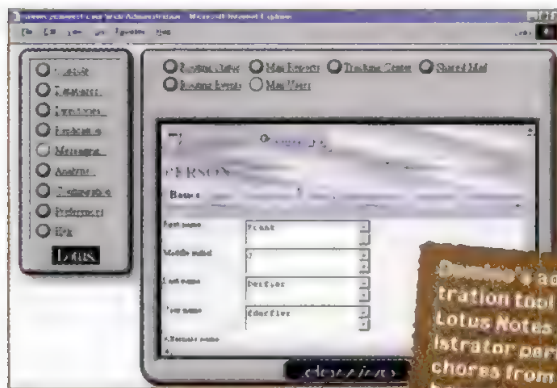


Domino R5 Server, Lotus Notes R5

Domino R5 Server, \$1,795 list; Lotus Notes R5, \$69 per user; Client Access License, \$40 per user per year. Lotus Development Corp., Cambridge, MA; 800-485-6887, 617-577-8500; www.lotus.com.



If this were summer camp, Lotus Notes would walk away with the Most Improved Camper award. With this release, Lotus's Domino R5 Server gains important new features, a smoother installation program, and improved management interface. The Notes client gets a makeover and new Internet functionality as well: All this earns Domino R5 Server and Notes R5 our Editors' Choice.



Lotus sells many Domino products, but we tested Domino R5 Server, which gives the power to host customized applications and use databases of up to 16GB. Domino R5 Server provides nearly any type of messaging connection and supports an array of server operating systems.

The wizard-guided installation took about 10 minutes to complete. When you start Domino R5 Server for the first time, an automated tool guides you through the initial server configuration. From there, you proceed to the Domino Administrator to manage users. Based on the new Notes R5 client, the Domino Administrator has a task-oriented multitab interface. A Web administration interface lets you perform basic tasks from any browser. Like previous Notes servers, R5 maintains

its own directory of users and now has database import tools to extract user lists and passwords from Windows NT domains and LDAP directory servers. Domino also includes data migration tools to import existing cc:Mail, GroupWise, Microsoft Exchange, and Netscape mail files and user databases. Lotus has also enhanced Domino's security, letting users employ two certificates (including an X.509 certificate) simultaneously.

The Notes R5 client adds support for NNTP Internet discussion servers and IMAP and POP3 mail servers. The Notes installer automatically locates your Notes ID file, connects to the proper Domino server, and locates POP3 and IMAP account information if your PC had

Microsoft Outlook.

Also, Notes R5 now accurately displays HTML-formatted e-mail messages and can show a complete header on an incoming message. A new Mail Rules tool makes it easy to filter out unwanted messages or to move incoming e-mail into specific folders. An improved signature feature lets you attach a signature to outgoing messages.

Lotus has replaced the old Notes user interface with a customizable welcome page that can display any mix of Notes and Web content. Users choose from several welcome-page templates or create their own. An icon-based bookmark bar replaces the desktop icons in the old Notes. A bookmark represents a database or an action. You can create as many bookmarks as you like.

The interface now has a taskbar mimicking the one in Windows. As you add new tasks in Notes, a new task icon appears at the top of the Notes window. You can quickly switch between Notes tasks by clicking on the task icon. The Domino Web interface looks like the new

Notes client and gives access to Notes mail, calendars, and to-do lists from any Web browser.

The Domino/Notes duo provides the same industrial-strength messaging and discussion engine as earlier Notes products. One of Notes' key strengths is its flexibility and extensibility. And Domino's revamped interfaces greatly improve the usability of an already excellent groupware package.—LF

GroupWise 5.5

5 users, \$718 list. Novell Inc., Provo, UT; 800-453-1267, 801-222-6000; www.novell.com.

● Novell's GroupWise 5.5 is a fine, low-cost choice for organizations that already use NetWare. GroupWise integrates with the NetWare Directory Services (NDS) making it easy to add to an existing NetWare installation. But its lack of a native Windows NT version makes GroupWise a tough sell to Windows NT shops.

When we last reviewed GroupWise, we encountered many installation problems that have since been fixed. The installation wizard now runs on a Windows workstation, instead of on the NetWare server, an improvement over the previous server-based, non-GUI installation. The wizard installs the appropriate server files and NetWare Loadable Modules, extends the NDS schema, creates the GroupWise server start-up file, and automatically starts the GroupWise server for you.

The wizard also installs the Message Transfer Agent (MTA), the GroupWise Internet Agent (GWIA), and the Post Office Agent (POA). The POA handles all of the messages within a GroupWise site. The GroupWise Internet Agent (GWIA) handles all off-site mail messages, and the MTA handles messages from different GroupWise systems. By default, GroupWise installs the message agents on the NetWare server. To run them on a Windows NT server, you must manually install them.

GroupWise is administered using an extension that adds several GroupWise menus to the standard NetWare Administrator program. GroupWise places an installable copy of the client files in a shared directory on the LAN, so end users can perform their own client installations with little or no help from the administrator. The GroupWise server

SUMMARY OF FEATURES

Groupware

PC MAGAZINE
EDITOR'S CHOICE

■ YES □ NO

	Domino R5 Server and Notes R5	GroupWise 5.5	Microsoft Exchange Server
List price	Server, \$1,795; \$69 per user	Server and 10 users, \$1,421	Server, \$501; \$56 per user

SERVERS

Operating systems supported:

Microsoft Windows NT Server 4.0 / NetWare 3.1x / 4.11

OS/2 Warp Server 4 / AIX

HP-UX / Solaris

Web server or equivalent HTTP services

Newsgroup server or equivalent NNTP services

Includes POP3/IMAP4 server or equivalent

Internet protocols supported by servers:

LDAP / SSL / SMTP

Network protocols supported by servers:

TCP/IP / IPX/SPX

NetBIOS/NetBEUI

CLIENTS

Native client available for:

Windows 95, 98, and NT Workstation 4.0

Macintosh / OS/2 Warp / Unix

Native client includes integrated:

Web browser/Newsgroup reader

POP3 / IMAP4 e-mail reader

User can access e-mail/discussions using a Web browser

MESSAGING

Native client's single in-box view can include:

E-mail messages/Voice mail/Fax

Calendar events/Tasks

Native client's e-mail contents can include in-line:

Rich text/Graphics/Forms

Clickable URL links/OLE 2.0 objects

User can delegate access to a private mailbox

COLLABORATION

Threaded discussions can include:

Infinite response levels

Rich text/Graphics/Forms

Clickable URL links/OLE 2.0 objects

Boolean searches

Data-store/topic/full-text searches

Integrated document management

SCHEDULING

User can schedule groups/resources

User can create links to e-mail/documents/discussions

Searches for free time slots of invitees

SYNCHRONIZATION

Clients can replicate message/calendar/documents

Supports synchronization at folder/document/field level

(1) Mail Transfer Agent (MTA) only (2) Requires free download. (3) MTA and Post Office Agent only.

provides native GroupWise services for GroupWise clients on the LAN. It also provides HTTP, IMAP4, POP3, and SMTP Internet mail services for clients on LAN or over the Internet.

The Windows-based GroupWise client provides a simple, tree-based interface to mail, calendar, and scheduling features. Incoming GroupWise and Internet e-mail messages appear in a single in-box. With a

few mouse clicks, you can convert any message to a calendar entry or schedule event. The only groupware product with shared document management, GroupWise offers check-in, checkout, and versioning.

Mobile users will also appreciate the Hit the Road feature, which provides one-click replication of your GroupWise workspace onto a notebook. Users can dial into their GroupWise server to receive

updates, or they can use GroupWise's HTTP, POP3, or IMAP4 server to connect to GroupWise over the Internet.

The GroupWise WebAccess client offers three views (plain HTML, frames, and Java-enhanced) of your GroupWise workspace. The Java enhanced interface provides the most functionality, letting you view and schedule appointments and work with shared documents through a browser interface that closely resembles the native GroupWise client. The plain HTML and frames interfaces have reduced functions but higher speed, which is useful during dial-up access.

GroupWise pairs a full feature set with an easy-to-understand user interface that would be most attractive to NetWare shops. The availability of a five-user version lets smaller organizations get a full-featured groupware package for little more than the cost of an IMAP server.—*LF*

Microsoft Exchange Server

Server, \$501 list; each user, \$56. Microsoft Corp., Redmond, WA; 800-426-9400; www.microsoft.com.

● There are two versions of Microsoft Exchange Server. The Enterprise Edition (\$1,613, plus \$56 per user) includes features like server clustering, support for multiple CPUs, and mainframe e-mail gateways that make it better for larger installations. Given the 50- to 200-user focus of our story, we reviewed the less expensive Standard Edition. Both products provide an essentially identical messaging feature set.

Except for a few minor improvements, notably the addition of Outlook 98 (Outlook 2000 is a free upgrade), improved public-key security, user-to-user chat features, and a Lotus Notes mailbox migration tool, Exchange hasn't changed much since our last review. But Microsoft plans to launch Exchange 6.0 soon after the release of Windows 2000.

Exchange runs only on Windows NT Server and tightly integrates with the Windows NT environment. The Exchange user database, for example, links to the Windows NT user directory. Each Exchange must have a Windows NT user account, where the OS (not Exchange) performs the user authentication. This allows a user to have a single account name and password for both Windows NT and Exchange Server. When you install Exchange Server,



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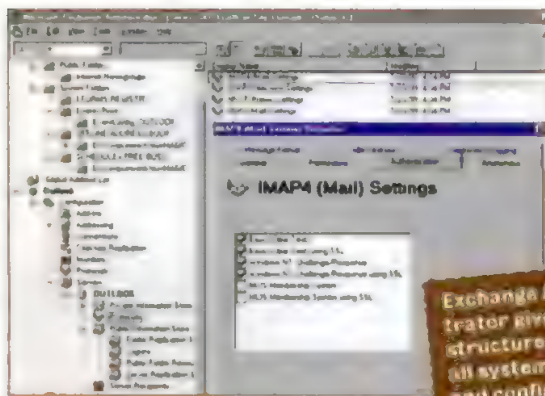
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you can use the Exchange administrator management tool to create an e-mail account automatically for every user in your Windows NT domain, and you can also import user lists from an NDS (NetWare Directory Services) directory. Exchange Server also interfaces with the Windows NT Performance Monitor and Event Log.

Simple to install and maintain, Exchange Server makes use of the Windows NT Internet Services Manager, the SMTP service, and Internet Information Server 4.0 (all part of the Windows NT Option Pack, which you'll need to have installed before you install Exchange). Exchange's wizard-guided installation takes about 30 minutes. The Exchange Administrator features a complete and comprehensible set of tools to help the system administrator fine-tune every configuration and performance aspect.

The administrator can grant or deny access to specific protocols on a user-by-user basis and can assign mailbox quotas



and message retention time limits on a per-user, per-group, or systemwide basis. Exchange provides a complete suite of Internet connectivity standards to support any e-mail client. An HTTP interface gives users access to their Exchange mail and calendars from a Web browser. But Exchange lacks a Web-based administration interface.

Bundled Outlook 98 provides e-mail and a calendar, contact manager, task list, and notepad. All these functions result in a more complicated user interface than the

other products in our roundup have, but the customizable Outlook View lets you select only the items you want to see when you first start the program. Outlook 98 handles multiple types of mail accounts: Exchange Server mail, POP3, and IMAP. Outlook 98's rules wizard makes it easy to categorize incoming mail based on plain-

English rules. It also includes a junk e-mail filter that lets you right-click on any new message to add the sender to the spam or adult-content mail filter.

Exchange's Web client closely mimics Outlook's user interface and provides access to mail, calendars, and shared discussion folders via the Web. The Web client includes an Out of Office assistant that lets you send an automatic reply to incoming e-mail messages.

Microsoft Exchange Server has strong administration tools and a feature set that is competitive with the roundup's other groupware products. Groupware features aside, Exchange is an excellent IMAP server, combining function with a complete set of management tools.—*LF* 



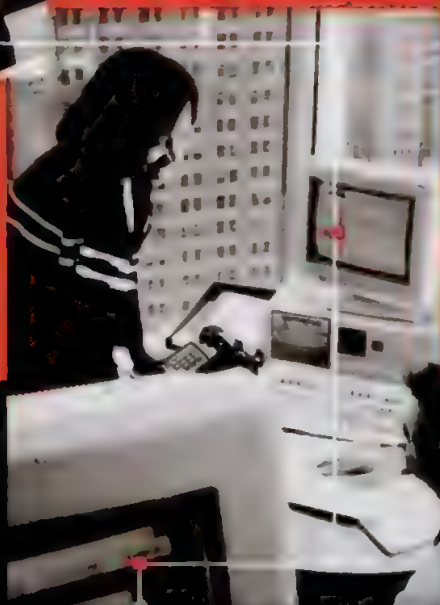
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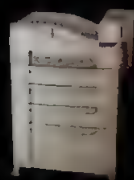
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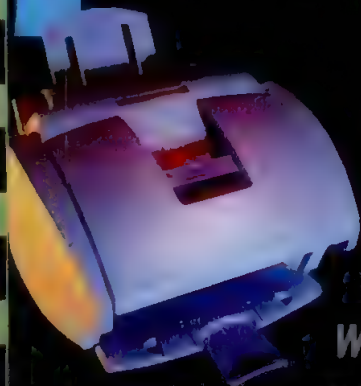
THE COLOR PRINTER COMPARISON HP DOESN'T WANT YOU TO SEE.

FEATURES	TEKTRONIX PHASER® 740	HP® 4540
MAXIMUM RESOLUTION	1200 dpi	600 dpi
FASTEST FULL-COLOR PRINT SPEED	5 ppm	4 ppm
POSTSCRIPT SUPPORT	Adobe PostScript® 3	PostScript 2 Clone
BUILT-IN NETWORKING	Yes	No
BUILT-IN REMOTE MONITORING	Yes	No
FREE, UNLIMITED PHONE SUPPORT	Yes	No
PRICE*	\$1895 1000	\$2499 1000

Surprised by the comparison? We're not. We've been busy perfecting color printing for more than 15 years, and developing breakthrough products such as the Tektronix Phaser® 740 color laser printer. It's the first workgroup printer to deliver amazing photo-quality color at an equally amazing price. Imagine, true 1200 dpi color output on everything from labels to letterhead. Dazzling color presentations and overheads. And a host of user-friendly features that make the Phaser 740 color laser as easy to use as it is to own. To learn more about the Phaser 740 color laser, or bringing color into your office, call 1-877-362-6567, ext. 1637 or visit www.tektronix.com/compare.

personal

Printers



We review 55 ink jet, laser, and multifunction printers. Find one that's right for you.

If you're in the market for a personal printer—a standalone printer, that is, not one designed specifically for network use—then your purchasing options have never been more wide open. There are ink jet printers that cost little more than some ink cartridges, top-of-the-line models that rival laser printers for quality, affordable monochrome and color lasers, and multifunction printers that make multitasking a breeze.



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To help you make a smart purchasing decision, PC Magazine Labs tested 55 ink jet, laser, and multifunction printers suitable for home or small-office use. We asked manufacturers to send us units matching the following criteria:

- a color ink jet that will be available at retail through the end of the year;
- a laser printer priced at \$1,000 or less (and except for the 17-ppm NEC SuperScript 1800, all of the lasers are in the 8- to 12-ppm range);

- a personal multifunction printer that offers scanning, copying, and/or faxing capabilities.

There are also photo printers from manufacturers like Acer, Epson, and Hewlett-Packard that deliver near-photographic-quality prints. Some of these units also accept CompactFlash and Smart Media for PC-free printing. You'll find reviews of these photo-specific printers in the First Looks section in an upcoming issue.

INK JET VS. LASER

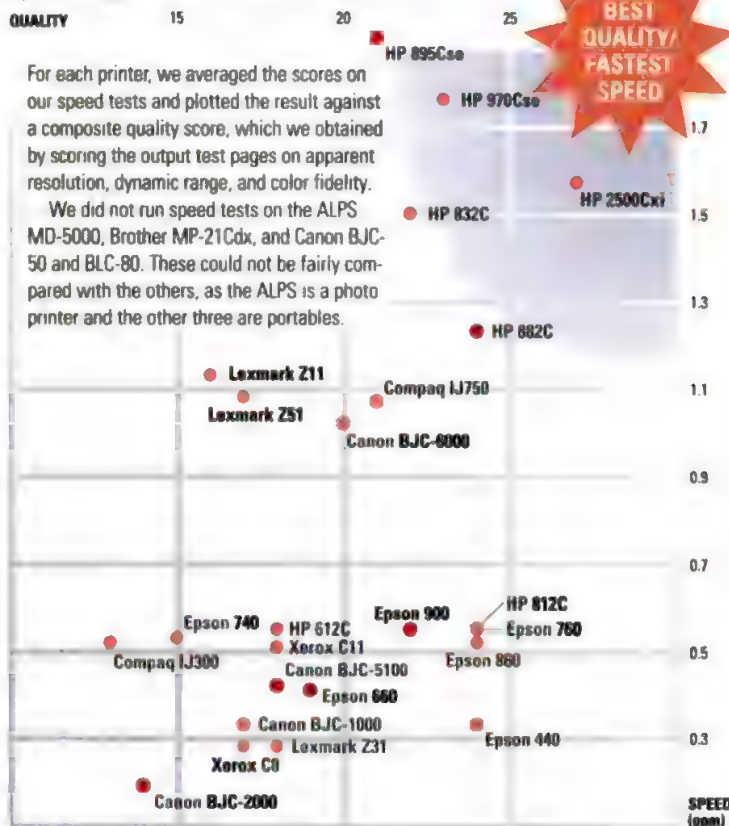
Lower prices for laser printers—the Brother HL-1240 and Okidata OkiPage 10e both have a street price of \$300—mean that cost is no longer the deciding factor in choosing an ink jet over a laser. But even though the playing field is virtually even with regard to pricing, there are still some elemental differences.

The quality of ink jets has improved so much that in most instances graphics out-

put is almost indistinguishable from the original. This makes ink jets the obvious choice for family use (book report covers, yard sales signs, and greeting cards) or for your home business (brochures, PowerPoint presentations, and prospectuses). Newly incorporated high-end features like the built-in duplexer of the HP DeskJet 970Cse expand the functionality

printers (most of last year's models hovered in the 6- to 8-ppm range), it's now possible to turn out multiple high-quality documents in a short period of time—at an affordable price. And if you need more printing power, the \$800 NEC SuperScript 1800 offers a speed of 17 ppm at a price that won't break the budget of most small businesses—all of which means that lasers will remain indispensable to the small-office user.

Quality vs. Speed: Ink Jets



of ink jets and point toward a future of ink jets in the office.

However, laser printers are the standard for clear, crisp text output. With the increasing speeds seen in personal laser

THE MARKETPLACE

When it comes to technology, the clear winner is ink jet. According to Lyra Research, a market research firm based in Newtonville, Massachusetts, that tracks the printer market, 1998 U.S. sales for all printers totaled 23.2 million units. Of this total, 14.9 million, or nearly two out of three printers, were single-function color ink jets. By 2003, total sales are projected to grow by a third to 30.9 million units, of which 76 percent—or 23.6 million—will be single-function ink jets.

The real winners will probably be the buyers. The total sales revenues for 1998 are estimated at \$16.6 billion, but despite the projected growth in unit sales, the total revenues for 2003 are projected to fall by more than 35 percent to \$10.7 billion. This market segment is expected to become even more competitive than it is now.

Improvements in ink jets—single- and multifunction models—have spelled big

LOOKING GOOD: INK JET OUTPUT

To the right, you'll find output samples from an entry-level and a high-end ink jet printer. They're indicative of the range of quality you'll find in the 28 ink jets we review here. The images were taken from our QualityLogic (formerly Genoa Technology) test suite and include a 300-dpi RGB Adobe Photoshop (PSD) print, a Microsoft Excel chart, and a Microsoft Word document.

Though both slices of cake look good enough to eat, the output on the left displays richer, warmer colors and greater detail (as is evident in the walnut).

Also note that the color of the chocolate is more accurate, without the orange tinge found in the print on the right.



sales, often at the expense of the laser printer. Lyra Research reports that lasers sold 3.7 million units in 1998, and over 5 years this figure is projected to drop by 22 percent to 2.9 million by 2003. There is some growth forecast for the midrange models used in corporate workgroups, but sales for the high- and low-end models are expected to decline. There will always be a market for laser printers, however, among those looking for speedy printing, ultra-crisp text, and workhorse functionality.

What is driving this extraordinary success on the part of color ink jets? First, last, and always is the low purchase price. Few printers in this class cost more than \$400. Five years ago, the big news was that a three-color ink jet printer got down to \$400 (the Lexmark ExecJet IIc). Now you can buy color ink jets for as little as \$50, and in some cases, they are given away free with a computer system.

The appeal of ink jets is more than just low price, however. Even the least expensive ink jets can produce photographic output that rivals or exceeds that of color ink jet printers of five years ago—at any price. And today's units in the \$150 to \$400 range can produce images that are difficult to distinguish from photographs, especially when paired with special photo color ink cartridges and glossy paper.

Ink jets still have their shortcomings. The biggest one is per-page costs. Ink cartridges remain expensive, so look carefully at the cost of consumables before you make a final decision. Our Ink Rundown test chart (see the sidebar "Think Ink") will give you a good idea of the number of high-coverage pages you can expect per ink cartridge. Cost per page was one of the factors we considered when selecting the HP DeskJet 882C as an Editors' Choice. In addition to its outstanding

Editors' Choice

- Ink jet: HP DeskJet 882C, HP 2500Cxi
- Laser: NEC SuperScript 1800
- Multifunction: HP OfficeJet R80



It's a banner year for anyone in the market for an ink jet printer. For homes and small offices, the HP DeskJet 882C (\$250 street) has all the essentials: speed, quality,

and ink efficiency. Though there are some less expensive printers in this market, this Editors' Choice—with its extensive bundle of graphics and project software—is a no-compromise solution. Honorable mention goes to the value-oriented Epson Stylus Color 440 (\$80) for its pleasing output and ease of use.

Professional users would do well to consider the workhorse HP 2500Cxi (\$1,000), our Editors' Choice for business use. This printer output an astounding 518 pages per cartridge on our Ink Rundown test, but it doesn't sacrifice quality for quantity. Its network option makes it perfectly suited for a workgroup or small office. Honorable mention in the business category goes to the Epson Stylus Color 880 (\$280) for its outstanding image quality and relatively fast printing speed, and to the HP DeskJet 970Cse (\$380), which is the first printer in its class to offer fully automatic duplexing.

In the laser category, NEC Technologies tops the field with the SuperScript 1800 (\$800). With its 17-ppm print engine, internal duplexer, and 65,000-page monthly duty cycle, it's hard not to be impressed with this office printer. Honorable mention goes to the only color laser in our group, the QMS magicolor 2 DeskLaser (\$999 list).

In our multifunction group, the HP OfficeJet R80 (\$800) takes the Editors' Choice. In addition to its top-notch printing capabilities, the unit offers scanning, faxing, and copying via a flatbed or a 30-page sheet feeder.

Of the three portable printers, the Brother MP-21Cdx, while not an Editors' Choice, was the best of the bunch.

image quality, it delivered 242 pages per cartridge on PC Magazine Labs' Ink Rundown test using a fairly dense graphic.

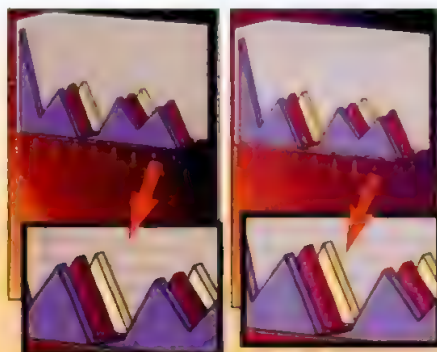
Paper handling also remains a weak point compared with the laser printers' input capacity and paper-handling options. One exception is the HP DeskJet 970Cse, with its built-in duplexer.

Another type of printer to consider is the multifunction ink jet device. These desktop Swiss Army knives can fax, copy, print, and scan—all in a single unit with a single, efficient connection to your computer. Lyra Research projects that sales

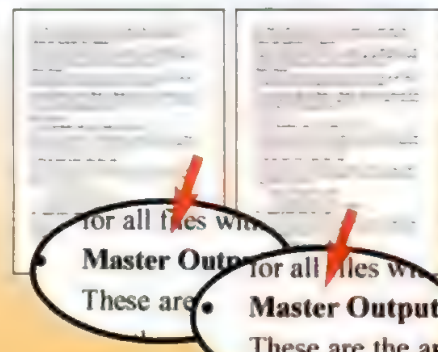
will equal about 10 percent of the single-function ink jet sales, with 1.4 million units in 1998 growing to 2.1 million units in 2003.

Perhaps the most important news about these multifunction units is that you no longer need to make any apologies for their speed or print quality—as evidenced by our top-rated HP OfficeJet R80. No longer are they "almost as good as" a "real" scanner, or copier, or printer. Today, they stand as equal to the single-function components that they replace. Many rely on the same high-quality ink jet print mechanisms that have made the

Depth of color is the most discernible difference in these two Excel charts. The image on the right appears somewhat washed out, and the black lines in the chart are not true black. The text on the left is also crisper and clearer.



The text in the document on the left appears crisp and pleasingly black. The printer's dedicated black cartridge ensures quality text output. Most entry-level printers, however, create black output by mixing cyan, magenta, and yellow ink. The result is the purplish cast.



The Canon BJC-6000

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ink tanks



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Rich, laser-quality black printing, plus 1440 x 720* dpi color printing for lifelike images.



*With optional Canon imagePROGRAF 1440 dpi print head. Estimated print speed at 300 dpi. Actual results may vary. ©2000 Canon U.S.A., Inc. All rights reserved.

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The Canon BJC-5100



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Value

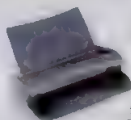
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paper versatility.





**The BJC-50
Color Bubble Jet
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*Holds up to
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The extreme portability of the Canon BJC-50 and BJC-80 Color Bubble Jet™ printers is

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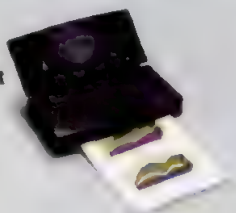
wherever you go, Canon portables offer crisp, desktop-quality printing and an optional pop-

in color scanner cartridge, too. So why not pick one up yourself? For more information,

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The BJC-80
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Compact 3.1 lb design.
Built-in 30-sheet feeder.



Optional
Battery Pack.

*Lasts for up to 200 pages
of printing per charge.*

standalone ink jet printers such top-notch performers. The scanning ability coupled with digital printing controllers makes a host of features possible, such as the ability to print multiple copies of a single image on a page or blow it up as a poster across multiple pages.

BEYOND THE PURCHASE PRICE

As you'll notice in our reviews, many of the larger companies have covered the market with product lines offering different models in just \$50 increments in street price. Take the time to consider all your needs and your budget before making a choice.

Total cost of ownership is more than just a corporate buzzword; it's a financial fact of life. If you don't expect to print many pages, then you don't need to bother with cost-per-page estimates.

Monochrome printing is also a factor. If printing text-heavy pages is your priority, though, you'll do well to go with a laser printer. It can output thousands of pages from a single toner cartridge, and you can't beat the text quality.

Also consider the cost of color. Not only do your per-page costs go up with a color ink jet compared with a monochrome laser, but the output speeds are slower, too. The speediest ink jet on our tests, the HP DeskJet 895Cse (\$300 street), averaged 2.8 ppm in printing a 1-page Microsoft Word document, while the \$300 Brother HL-1240 laser accomplished the same task at a rate of 4.2 ppm.

If you want everything and have nothing, consider a multifunction device. Even though the separate components—printer, scanner, copier, fax—may be found for the same price or less, the advantages of space savings and ease of use give the all-in-one devices a distinct edge.

Whether you choose an ink jet, laser, or multifunction printer, one thing is certain: You'll be getting higher quality and greater functionality than ever before.

Our Contributors: BRUCE BROWN, DANIEL GROTTA, SALLY WIENER GROTTA, DAVID HARVEY, ALFRED POOR, and M. DAVID STONE are contributing editors of *PC Magazine*. Associate editor JENNIFER TRIVERIO and PC Magazine Labs project leader S. JAE YANG were in charge of this story.

ink jet printers

ALPS MD-5000

2 ppm monochrome; 600 x 600 dpi. \$500 street. San Jose, CA; 800-445-6190; www.alpsusa.com.

● The ALPS MD-5000 is a hybrid printer capable of outputting true continuous-tone prints, as well as very good-looking graphics and text on plain paper. Although ALPS targets the MD-5000 primarily at family and small-office users, it's too slow, expensive, and limited for these markets.

ALPS's unique Micro Dry cartridge system and variable-dot technology ensure great-looking graphics and text. Since the MD-5000 was the only dye-sublimation printer in our roundup, we expected it to score high on our photo test: It did, but at a snail's pace. The dye-sublimation kit that produces the photo-realistic output is a \$100 option. The MD-5000 wasn't included in the speed testing we performed; its different print technology makes fair comparison with other ink jets impossible.

During printing, an *undercoat ribbon*, or finishing layer, makes it possible to produce high-quality output on photocopy paper. Although print quality looks great to the untrained eye, a closer examination reveals readily discernible banding where the half-inch ribbon swaths stitch together.

The MD-5000 is versatile in that it can be set up as a parallel, USB, or SCSI

device, and it works with PCs or Macs. Ink cassettes are easily installed and mess-free. With optional cassettes, the unit can also produce metallic, fluorescent, or foil output for snazzy special effects. But knowing which ones to install for what kind of output—as well as setting the driver—can be confusing.—*Daniel Grotta and Sally Wiener Grotta*

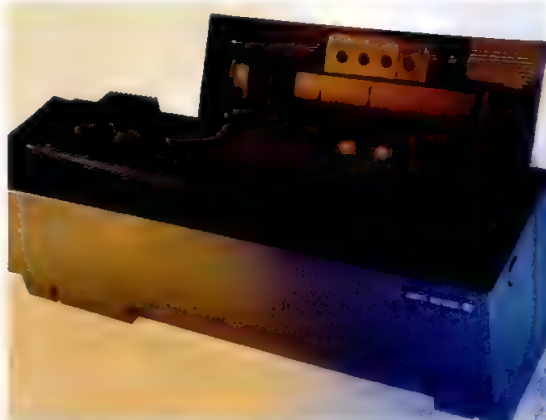
Brother MP-21Cdx

2.5-ppm monochrome/2.5-ppm color portable; 720 x 720. \$350 street. Bridgewater, NJ; 888-879-3232; www.brother.com.

● New mobile printers are usually incremental upgrades of existing models, but the Brother MP-21Cdx is a brand-new design in portable printers featuring reasonable print quality from a 720-dpi piezo-electronic printhead and a clever combination of connection options, the simplest of which provides both power and data to the printer via a single PC Card. The MP-21Cdx is not very fast, nor is it particularly great at printing photographs, but neither concern addresses its strong points: The tiny new Brother is eminently portable, connects to a notebook PC quickly and simply, and does a fine job of printing documents with text and graphics.

The *dx* in the unit's model name indicates that this is the deluxe version; it's the one we recommend. The Brother MP-21C (\$300 street) is the same printer without the parallel-port adapter, detachable 30-page sheet feeder, or AC adapter. The sheet feeder alone is worth the extra \$50, because feeding paper one sheet at a time from the rear of the printer is a bit awkward. For sheer portability, however, the 4.2- by 11.8- by 2.0-inch (HWD) Brother portable is a cinch to pack, weighing just 2.2 pounds with the PC Card connector and cable.

Text printing is the MP-21Cdx's real strength, though the standard black/cyan and



The ALPS MD-5000 was the only dye-sublimation printer in our roundup.

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- Floppy disk drive bay also supports second rechargeable battery when floppy drive is removed
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- Supports Two Type II Cards or one Type III Card CardBus Support

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- AC Adapter **PCGA-ACX1: \$99.99.** Get an additional AC adapter and keep one at home and one at work.
- All-in-One Carrying Case **PCGA-CCF: \$99.99.** Easily holds notebook and accessories.
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- MaxMobility: Less than 7 lbs., 1.6" thin¹

Plus:

- All-in-One design
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All-in-One Software

Operating System

- Microsoft® Windows® 98 second edition

Applications

- Adobe Acrobat® Reader
- Adobe PhotoDeluxe® Business Edition
- Apple QuickTime™
- Intuit® Quicken® Basic 99
- Mediomatic DVD Express (F360 and F350 only)
- Microsoft Money 99
- Microsoft Outlook® 98
- Microsoft Word® 97
- Microsoft Works 4.5
- Softlink® in Chorus™
- Sony DVgate™ Motion
- Sony DVgate Still
- Sony Media Bar
- Sony PictureGear™
- Sony Smart Capture
- Sony Smart Connect
- Sony Smart Label
- Sony Smart Publisher
- Sony Smart Write
- Symantec WinFax® Basic Edition

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- America Online®⁶
- AT&T WorldNet® Service⁶
- CompuServe® 2000
- EarthLink Sprint TotalAccess™⁶
- Microsoft Internet Explorer for Windows® 98
- Mindspring Internet Service⁶
- Netscape® Communicator
- Prodigy Internet⁶

Tool Center

- McAfee VirusScan®
- Sony BatteryScope
- Sony PowerPanel
- Sony Notebook Setup
- Sony PPK Setup
- Sony Application Recovery CD
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INK JET PRINTERS

	Street price	Text quality	Photo quality	Overall speed	Service and Reliability grade*
ALPS MD-5000	\$600	Good	Excellent	Poor	B
Brother MP-21Cdx	\$350	Good	Fair	Poor	D
Canon BJC-50	\$350	Excellent	Good	Poor	D
Canon BJC-80	\$300	Excellent	Good	Poor	D
Canon BJC-1000	\$50	Good	Fair	Poor	D
Canon BJC-2000	\$70	Excellent	Good	Poor	D
Canon BJC-5100	\$150	Excellent	Excellent	Fair	D
Canon BJC-6000	\$200	Excellent	Good	Good	D
Compaq LJ300	\$100	Fair	Fair	Poor	—
Compaq LJ750	\$150	Good	Good	Fair	—
Epson Stylus Color 440	\$80	Excellent	Good	Fair	A
Epson Stylus Color 660	\$130	Excellent	Good	Good	A
Epson Stylus Color 740	\$200	Excellent	Excellent	Good	A
Epson Stylus Color 760	\$230	Excellent	Excellent	Good	A
Epson Stylus Color 860	\$280	Excellent	Excellent	Excellent	A
Epson Stylus Color 900	\$400	Excellent	Excellent	Excellent	A
HP DeskJet 612C	\$100	Excellent	Excellent	Poor	A
HP DeskJet 812C	\$150	Excellent	Excellent	Good	A
HP DeskJet 832C	\$200	Excellent	Excellent	Excellent	A
EDITOR'S CHOICE HP DeskJet 882C	\$250	Excellent	Excellent	Excellent	A
HP DeskJet 895Cse	\$300	Excellent	Excellent	Excellent	A
HP DeskJet 970Cse	\$380	Excellent	Excellent	Good	A
EDITOR'S CHOICE HP 2500Cxi	\$1,000	Excellent	Good	Excellent	A
Lexmark Z11	\$50	Fair	Fair	Poor	B
Lexmark Z31	\$150	Good	Good	Good	B
Lexmark Z51	\$200	Good	Good	Fair	B
Xerox DocuPrint C8	\$100	Good	Fair	Fair	B
Xerox DocuPrint C11	\$200	Good	Good	Good	B

* PC Magazine, July 1999. A dash indicates that the vendor was not represented in our published survey results.

magenta/yellow ink cartridges also enable color graphics and even photographic-image printing.—*Bruce Brown*

Canon BJC-50, BJC-80, BJC-1000, BJC-2000, BJC-5100, BJC-6000

BJC-50: 5.5-ppm monochrome/2-ppm color portable ink jet; 720 x 360. \$350 street. **BJC-80:** 4.5-ppm mono/2-ppm color portable; 720 x 360. \$300. **BJC-1000:** 4 ppm mono/0.6 ppm color; 360 x 360. \$50. **BJC-2000:** 5 ppm mono/2 ppm color; 720 x 360. \$70. **BJC-5100:** 10 ppm mono/4 ppm color; tabloid size; 1,440 x 720. \$150. **BJC-6000:** 8 ppm mono/5 ppm color; legal size; 1,440 x 720. \$200. Costa Mesa, CA; 800-652-2666; www.ccsi.canon.com.

● The six Canon printers included in this roundup fill every ink jet niche in the low-end to medium range. The three-color Canon BJC-1000 and four-color BJC-2000 are truly personal printers. Both are inexpensive, slow, and a little wanting in image quality; either is suitable—particularly as a second printer—for those on a tight budget who need light-duty printing. The BJC-5100 and the BJC-6000 are suitable for a home office or as personal

printers in a small office. Both offer reasonable speed and image quality, though the BJC-5100 offers better-looking output than the BJC-6000. Canon even offers a choice in portable printers. The BJC-50 and BJC-80 offer acceptable speed and quality for portable printers.

BJC-1000, BJC-2000: Printing on a Budget

The BJC-1000 and BJC-2000 offer virtually identical setup and drivers. As with all these printers, the installation process is quick and easy, thanks in large part to a well-designed quick-start guide. Setup consists of little more than installing a paper support for the input tray, connecting the power cord and power cable, installing an ink cartridge, and then installing the driver from the CD.

The printers use different cartridges, but both offer a choice among standard, photo, and neon (fluorescent) inks. Both the BJC-1000 and BJC-2000 also offer a

set of software programs bundled as Canon Creative Home. These include a greeting card program, a simple graphics program, and a collection of templates. The drivers offer a watermark feature and the ability to print two or four pages on a single sheet of paper.

Output quality for the BJC-1000 was acceptable but not a match for the best ink jet printers. Text was dark and readable. Graphics showed obvious dithering, with posterization in gradients. Colors in graphics were fully saturated, but dark blues and greens were a little muddy. Photos on glossy paper had brighter colors, but round objects looked flattened because of a loss of subtle shading, and a close look showed dithering in some colors. Finally, speed is not the unit's strong suit. This is not a bad printer for the price, but it's hard to recommend unless you're on the tightest of budgets and don't have to print many pages.

The BJC-2000 fared a bit better on output quality. Text was dark and highly readable. Graphics showed visible dithering patterns and gradients showed posterization, but colors were bright and fully saturated. Photos printed on photo paper showed only a hint of dithering. There was a flattened effect from a loss of subtle shading, but the effect was less severe than in output from the BJC-1000. As with the BJC-1000, speed is an issue for the BJC-2000, but the convenience of having a four-color cartridge, rather than having to switch between monochrome and color, makes this printer easier to recommend for those on a tight budget. Note, too, that Canon sells a scanning cartridge option (\$19 list) to let the BJC-2000 double as a scanner. Alas, the inconvenience of having to change cartridges limits this feature to strictly occasional use.

BJC-5100, BJC-6000: Solid Small-Office Choices

Installing the BJC-5100 is similar to installing the BJC-1000 and BJC-2000: Plug in the power cord and cable, install the ink, then install the driver and, optionally, the bundled programs. The BJC-5100's driver does not offer extras such as a watermark feature. The printers are bundled as the Canon Creative Pro package and include a set of templates, WebRecord

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Think Ink

Consumables—paper and inks—are a major component of using an ink jet printer. We thought it would be interesting to find out just how many printed pages you could expect from an ink jet before you needed to drop in a new ink cartridge. For each printer, we measured the number of pages produced with a set of new ink cartridges.

We automated the Ink Rundown test using Wilson WindowWare's Win-Batch-Compiler. To use this tool, we programmed a script to print ten pages of our Ink Rundown test target (pictured here) and then to rest the printer for 10 minutes. The script repeated until the printout lacked at least one color element. We developed the Ink Rundown test to simulate a typical document consisting of color graphics and text. Of our one-page target, 30 percent was covered with an even distribution of colors (cyan, magenta, yellow, red, green, blue, and black) and 5 percent was black text.—*S. Jae Yang*



Bold type denotes first place. ■ denotes Editors' Choice.	Pages per cartridge	Cost per color cartridge	Cost per black cartridge
ALPS MD-5000	38.0	\$6.99*	\$8.99
Brother MP-21Cdx	27.5	\$31.99	\$31.99
Canon BJC-50	13.0	\$21.95	\$11.95
Canon BJC-80	18.5	\$21.95	\$11.95
Canon BJC-1000	67.5	\$38.95	\$32.00
Canon BJC-2000	44.5	\$21.95	\$ 8.25
Canon BJC-5100	49.5	\$21.95	\$36.99
Canon BJC-6000	144.5	\$11.95*	\$13.99
Compaq LJ300	50.5	\$32.99	\$31.99
Compaq LJ750	56.0	\$39.99	\$32.99
Epson Stylus Color 440	122.5	\$29.95	\$24.95
Epson Stylus Color 660	128.5	\$29.95	\$24.95
Epson Stylus Color 740	112.0	\$29.95	\$29.95
Epson Stylus Color 760	153.0	\$29.95	\$29.95
Epson Stylus Color 860	151.5	\$29.95	\$24.95
Epson Stylus Color 900	236.0	\$39.99	\$54.99
HP DeskJet 612C	99.0	\$27.00	\$30.00
HP DeskJet 812C	135.0	\$24.00	\$29.00
HP DeskJet 832C	276.5	\$33.00	\$29.00
■ HP DeskJet 882C	242.0	\$33.00	\$29.00
HP DeskJet 895Cse	245.5	\$33.00	\$29.00
HP DeskJet 970Cse	123.5	\$33.59	\$29.00
■ HP 2500Cxi	518.0	\$30.00*	\$30.00
Lexmark Z11	53.0	\$35.99	\$29.49
Lexmark Z31	63.0	\$35.00	\$29.49
Lexmark Z51	122.5	\$36.95	\$29.49
Xerox DocuPrint C8	42.7	\$11.50*	\$20.00**
Xerox DocuPrint C11	152.0	\$40.00	\$20.00**

(which combines multiple Web sites onto one page), and Adobe PhotoDeluxe Business Edition for image editing.

One unusual feature of the tabloid-size BJC-5100 is that it can hold either one or two sets of ink cartridges. Install two four-color cartridges, for example, and it will print using both to speed print time. Install one standard four-color cartridge and one photo color cartridge and it can print either four-color images or seven-color photos without your having to change cartridges.

Output quality on our tests was more than acceptable. Edges and thin lines in text and graphics were crisp; colors were generally bright, though some had a slightly pastel look; and gradients showed only a hint of posterization. Photos on high-gloss photo film rated as true photo quality, retaining the subtle shading to give rounded objects a 3-D look. Although it was no speed demon, the BJC-5100 was fair for an ink jet printer. All told, the unit is impressive for its price.

The BJC-6000 comes with essentially the same driver as the BJC-1000 and BJC-2000 but has more in common with the BJC-5100. Like the BJC-5100, the BJC-6000 has room for two sets of ink cartridges, but each color ink is in a separate cartridge. When one color runs out, you need replace only the cartridge for that color.

The BJC-6000 was not quite on a par with the BJC-5100 for output quality. Edges and thin lines in text and graphics

were suitably crisp. Colors were a bit muddy, however. Photos on high-gloss film showed a slight flattening effect compared with the BJC-5100's output, due to a loss in subtle shading. The BJC-6000's performance was substantially faster, however, which means that the higher price buys you much faster performance with a small loss in quality. In case quality is more important to you than speed, however, the BJC-5100 offers better output quality at a lower price.



The Canon BJC-50 and BJC-80 portables make printing on the go a snap.

BJC-50, BJC-80: Portable Printers

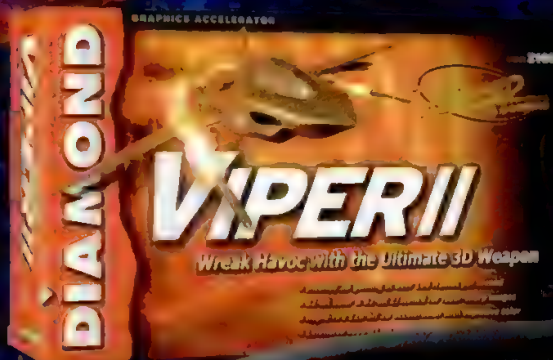
The BJC-50 comes standard with a battery but forces you to hand-feed paper. The BJC-80 adds a paper feed for more convenience and faster printing—achieved by not making you feed the paper by hand—but provides a battery only as a \$69 option (list price). Canon's two portable printers are similar to each other in most respects, including support for a \$99 scanning head option. Replace the ink cartridge with the scan head and you

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PERFORMANCE TESTS

Ink Jet Printers



Hewlett-Packard's fleet of ink jet printers consistently led the way on our tests. Among them, the HP DeskJet 882C and 895Cse demonstrated the best balance of speed, image quality, and ink durability.

Today's ink jet printers have better image quality and are used more often to produce graphics documents. Therefore this year's speed test targets were more complex than last year's. As a consequence, the performance scores here were lower than those in last year's roundup.

The increased complexity of our test targets also widened the performance gap between ink jet printers and lasers. Last year, we saw the fastest ink jets outperform some of the slower laser printers in printing simple documents. The print engines in high-end ink jets have gotten faster, but the complexity of this year's test targets was more demanding of host-based-processing printers—like ink jets—than of the tested laser printers, which are equipped with their own processors.

The top five speed test performers came from Hewlett-Packard (the DeskJet 895Cse, 882C, 832C, and 812C and the 2500Cxi). The glaring weakness in these HP printers, however, was their return-to-application times, which indicate that they hamper the host PC for a long time when printing graphics-intensive jobs such as PowerPoint slides. We observed and reported this problem last year, too, but HP has not remedied it. In printing the 12 PowerPoint slides, the HP DeskJet 970Cse tied up the system for almost 14 minutes before returning control to the user. Canon, another offender from last year, solved the slow return-to-application problem for its BJC printers, except for the BJC-5100.

We rated the Canon BJC-6000, Compaq LJ750, and Lexmark Z31 nearly equal to the top HP printers in terms of speed and quality (see the chart "Quality vs. Speed"). The Epson Stylus Color-series printers—the 440, 760, and 860 in

particular—also produced documents with image quality in the HP printers' class, but the HP printers performed this feat two to three times as fast. In all fairness, however, we set the Epson printers to 720 dots per inch, higher than the HP printers' 600 dpi. At the low end of the speed ranking, the Epson Stylus Color 440, Xerox DocuPrint C8, Lexmark Z11, and Canon BJC-1000 and BJC-2000 turned in the most frustratingly slow performance.

How We Tested

For measuring printer speed, we used the automated printer performance test PageSense 99, developed by QualityLogic to PC Magazine's specifications. California-based QualityLogic (formerly Genoa Technology) specializes in developing automated tests for printers, scanners, fax machines, and other technologies. We connected all the printers to Pentium II/400-based Dell Dimension XPS R400s with 128MB of RAM and 13GB EIDE hard disks, running Windows 98 with monitor resolution set to 1,024-by-768 in true color. On each system, we set the parallel port to enhanced capability port (ECP) mode and the spooling mode to EMF, unless a vendor specified otherwise. We ran all tests with the printers' drivers set to 600 dpi, or as close to it as possible, in text and graphics mode. Whenever possible we disabled the printers' power management features.

PageSense 99 uses the programming platform Rational Visual Test for automating the application-based printer testing. The system uses an LED-based sensor that detects the pages produced and released by the printer. With the sensor PageSense 99 measures the return-to-application time and the time it takes to print each page. We measured the *click-to-clunk time*, which we define as the duration from the moment you click the OK button in the print dialog box to the moment the last page is released to the output tray. In the chart, we present the data in *effective pages per minute*—a calculation based on the click-to-clunk time, which includes the first-page-out delay before each job.

We worked with QualityLogic to select a special suite of test targets that can measure a printer's real-world performance as well as evaluate various attributes that contribute to print quality. (The select suite of targets will be distributed by QualityLogic as part of the PageSense 99 package, and a subset of this suite will be posted on our Web site.) To evaluate an ink jet printer's text and graphics quality, we examined output

turn either printer into a scanner—a neat trick if you need to scan and e-mail something from your hotel room.

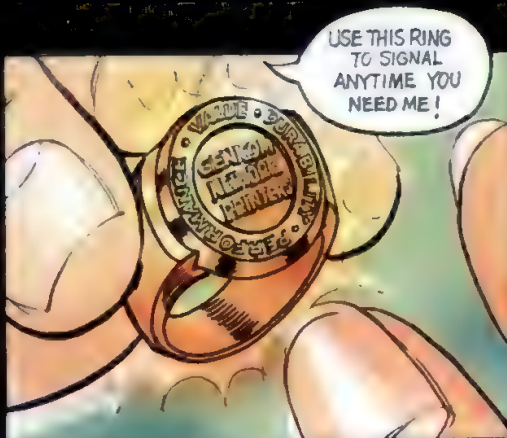
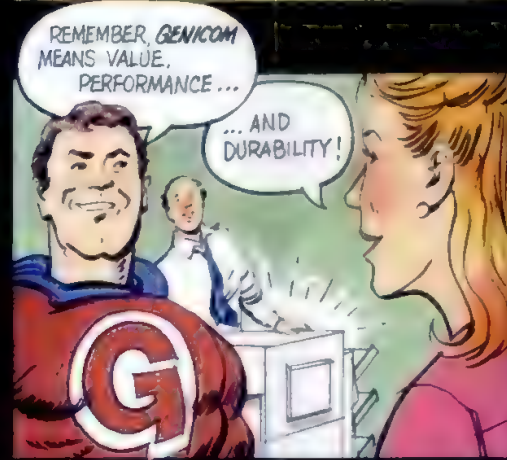
Setup for both is similar in general description, though it differs in some details. For the BJC-50, you need to install the battery first, even if you plan to plug in the AC adapter. Then, for either printer, you can plug in the parallel cable or take advantage of the built-in IR port to communicate with your computer, plug in the power cord (an optional step for the BJC-50), install the ink cartridge, and then install the driver. The drivers do not offer such extras as a watermark feature.

Output quality for the BJC-50 was less than ideal on our tests but better than you might expect from a portable printer. Text was suitably dark and readable. Text and graphics offered sharp edges for thin lines and edges. Graphics showed easily visible dithering patterns, and gradients showed posterization, but both effects were relatively minor. Colors were bright and fully saturated. Photos on glossy paper had a slightly flat look but were well within the acceptable range.

The BJC-50 is inherently slow and made even slower by the fact that you have to hand-feed each page. Still, it's a

good choice if you need to print while sitting in a car, on a plane, or anywhere else that is short on space and may not be near a power outlet.

The BJC-80's output on our tests looked nearly identical to the BJC-50's output, which we expected since the two use the same print mechanism. Throughput from the BJC-80 was a little better, though, if only because the 30-sheet paper tray speeds the process of feeding the next sheet. In sum, this is a good choice for those who do their portable printing in a hotel room or a borrowed office.—M. David Stone



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PERFORMANCE TESTS

Effective ppm High scores are best.	Microsoft Word 97				Microsoft Excel 97			Netscape Navigator 4.6	Microsoft PowerPoint 97
Bold type denotes first place; denotes Editors' Choice	1-page letter	12 pages, unformatted text	12 pages, formatted text	12 pages, text and graphics	1-page table	3 pages, text and graphs	1-page graph	2 Web pages	12 pages, slides
Canon BJC-1000	0.5	0.3	0.4	0.3	0.4	0.2	0.2	0.3	0.2
Canon BJC-2000	0.3	0.3	0.3	0.2	0.1	0.1	0.1	0.1	0.1
Canon BJC-5100	0.7	0.6	0.7	0.2	0.8	0.2	0.2	0.2	0.1
Canon BJC-6000	1.4	1.7	1.6	0.6	1.9	0.5	0.4	0.6	0.4
Compaq IJ300	0.8	0.6	0.8	0.6	0.8	0.3	0.2	0.3	0.3
Compaq IJ750	1.5	2.0	2.0	0.7	2.0	0.5	0.4	0.3	0.2
Epson Stylus Color 440	0.3	0.6	0.4	0.2	0.9	0.2	0.1	0.2	0.2
Epson Stylus Color 660	0.4	0.6	0.5	0.3	0.8	0.2	0.2	0.3	0.2
Epson Stylus Color 740	0.6	0.8	0.7	0.4	0.9	0.4	0.4	0.4	0.4
Epson Stylus Color 760	0.4	1.0	0.6	0.4	1.2	0.3	0.3	0.5	0.3
Epson Stylus Color 860	0.2	1.1	0.5	0.4	1.2	0.3	0.3	0.3	0.3
Epson Stylus Color 900	0.6	0.7	0.6	0.2	1.2	0.4	0.4	0.4	0.4
HP DeskJet 612C	0.8	1.5	0.6	N/A	0.8	0.1	0.1	0.3	0.1
HP DeskJet 812C	2.4	3.2	3.2	0.7	2.1	0.5	0.5	0.6	0.4
HP DeskJet 832C	3.8	2.0	1.3	0.3	2.1	0.5	0.5	0.6	0.2
HP DeskJet 882C	2.6	3.6	3.6	1.1	2.2	0.6	0.7	0.9	0.6
HP DeskJet 895Cse	2.6	3.7	3.7	1.3	2.3	0.7	0.9	1.1	0.7
HP DeskJet 970Cse	1.8	2.8	2.9	0.5	0.9	0.3	0.3	0.4	0.3
HP 2500Cxi	2.7	4.5	3.1	0.6	1.3	0.5	0.4	0.6	0.4
Lexmark Z11	0.2	0.2	0.2	0.2	0.8	0.4	0.2	0.3	0.1
Lexmark Z31	1.7	2.0	2.1	0.6	2.1	0.4	0.4	0.3	0.2
Lexmark Z51	0.5	0.4	0.5	0.3	0.5	0.2	0.2	0.3	0.2
Xerox DocuPrint C8	0.2	0.5	N/A	0.4	0.6	0.1	0.1	N/A	0.1
Xerox DocuPrint C11	0.7	1.4	1.1	0.2	0.7	0.1	0.1	0.2	0.1
AVERAGE	1.3	1.7	1.6	0.6	1.4	0.4	0.4	0.4	0.3

N/A—Not applicable. The printer was unable to complete this test.

samples from our performance tests and rated them on apparent resolution, dynamic range, and color fidelity.

The **1-page letter** test measures speed when printing a single-page Microsoft Word 97 document consisting of formatted text. With the **12 pages, unformatted text** test, we measure each printer's speed when producing a Word 97 document consisting purely of 10-point Times New Roman text.

The **12 pages, formatted text** test uses a target with added complexity. This Word 97 document includes various fonts, tables, and formats, as well as some lines and borders in color. With the **12 pages, text and graphics** test, we measure printer speed when producing a Word 97 document with numerous bitmap and vector color graphics.

For the **1-page table** test, we print a single-page Microsoft Excel 97 spreadsheet with a table of numbers. The **3 pages, text and graphs** test target consists of multiple tables of numbers and

embedded graphs in various colors. For the **1-page graph** test, on a separate Excel worksheet we print, in landscape mode, an 8-by-10-inch graph with 0.5- to 2.0-point lines on a background of solid black.

We use Netscape Navigator 4.6 to print **2 Web pages** with a mixture of text and photos on a dithered color background. Finally, we print the **12 pages, slides** from Microsoft PowerPoint 97. These slides contain a mix of text, graphics, and complex background patterns.

This year, we have added to our test suite the Ink Rundown test—which was unprecedented in our lab. We report the interesting findings in our sidebar "Think Ink." We have also examined and rated the image quality of the ink jets' output samples. These results are plotted on the chart "Quality vs. Speed."

—Analysis written by S. Jae Yang. Special thanks to Pete Duff and Ken Kim of QualityLogic.

Compaq IJ300, IJ750

IJ300: 4 ppm monochrome/2.5 ppm color; 1,200 x 1,200.
\$100. IJ750: 7 ppm mono/3.5 ppm color; 1,200 x 1,200. \$150.
Houston; 800-345-1518; www.compaq.com/athome.

● Compaq's ink jets bear a strong family resemblance to the Lexmark line: they even use similar driver software. The Compaq IJ300 is aimed at the entry-level market, with a street price of just \$100. Although its output is of adequate quality, it is slower than average. The IJ750 has a price of \$150 and is aimed at mid-level users. It has about average speed, and its

four-color ink cartridge with optional photo inks produces output on a par with that from most of the competition.

Both printers offer 1,200- by 1,200-dpi resolution, with 600 dpi as an option. They offer a printhead-alignment procedure for use when changing cartridges, and the driver provides a useful on-screen monitor that includes an ink-level indicator. Both printers also come with ArcSoft's Photo Printer, which can print multiple Web pages on a single sheet of paper and can format and print photographs. Additionally, the IJ750

includes Corel PrintHouse Magic, which can be used to create greeting cards, labels, and banners.

The IJ300 had fairly good print quality, though there was noticeable streaking on some prints, and the composite black was not as crisp and deep as black ink should be. This model should be sufficient for printing home snapshots. It was slower than many of the other printers here, however, so you may want to pay a little more to get the IJ750's four-color ink (or a photo cartridge) and faster output.

The IJ300 exhibited its low price in

NEC

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Introducing the SuperScript 870, a new laser printer that's fast, efficient, and easy to use. It's a great choice for home and office use. The SuperScript 870 is a great choice for home and office use. The SuperScript 870 is a great choice for home and office use.



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other ways: The input paper tray was weak, and it was too easy for the paper stack to flop over to one side. On the plus side, the IJ300 driver has a "color sort" option which prints all the pages that require color first, then pauses so that you can switch to the black cartridge to print the rest of your document.

The IJ750 has an edge over the IJ300 on both print quality and speed. It was two to three times as fast on a number of tests, although this brought it up to only about the average range for the rest of the printers in this group. The driver offers many more settings, including support for different paper types and color modes. The addition of black ink for color printouts greatly improves the darker shades and increases contrast. Aside from some streaking on some glossy paper printouts, the IJ750 had good print quality and produced attractive photographs. The printer has flexible paper handling with two input slots, and it also comes with a shelf design to hold fanfold paper for printing banners.—AP

Epson Stylus Color 440, 660, 740, 760, 860, 900

440: 4 ppm monochrome/2.5 ppm color; 720 x 720. \$80 street. **660:** 5 ppm mono/3.5 ppm color; 1,440 x 720. \$130. **740:** 6 ppm mono/5 ppm color; 1,440 x 720. \$200. **760:** 7 ppm mono/6 ppm color; 1,440 x 720. \$230. **860:** 9.5 ppm mono/7 ppm color; 1,440 x 720. \$280. **900:** 12 ppm mono/10 ppm color; 1,440 x 720. \$400. Torrance, CA; 800-463-7766; www.epson.com.

●Epson America continues to be a major player in the ink jet printer market, with five new models (and one returning Editors' Choice selection, the Stylus Color 440) that represent a wide range of prices and print speeds and differ in bundled software. One factor in common across all models is excellent photo printing, with very good reproduction even from the lowest-priced model.

The Epson Stylus Color 440, intended for new users, is a bargain-priced sub-\$100 ink jet and the only printer in the current lineup limited to 720-dpi-resolution printing. The Epson Stylus Color 660, intended as a strong competitor for

home markets, is the low-end 1,440-by-720-dpi printer (the maximum resolution shared by all models numbered 660 or higher). The higher quality makes a discernible difference, particularly in photo printing. The Stylus Color 740, which targets home offices, adds variable-size droplets as small as 6 picoliters to the feature set for even higher-quality printing. Moving up incrementally, the Stylus Color 760, with 4-picoliter-minimum



Epson delivers a line of Stylus Color printers that should fit any budget.

droplets, is intended for small offices. Epson justifiably describes the Stylus Color 860 as the best in its line for business use, and the top-of-the-line Stylus Color 900, with 3-picoliter-minimum droplet size, is for demanding professional applications. You can pick your price point and performance level with assurance, knowing that any Epson ink jet will be a good one.

The entire line of Epson ink jets acquitted themselves admirably on our Ink Rundown test, ranging from 112 test pages per cartridge for the Stylus Color 740 to a 236-page yield for the Stylus Color 900 (note that the 900 uses cartridges that cost about \$20 more than the other Epson's).

All Epson printers install via software on CD and include an informative book on Printer Basics and a trifold color setup brochure with a CD pocket. Rather than following the Windows 98 default of recognizing a new printer and looking for drivers, users need to run the Epson setup program, which installs drivers, configures the printers, performs a self-test, and installs the bundled software. Experience has shown that if you go out

of order, the installation process can bog down, but if you follow the simple directions, all goes quickly and smoothly.

At Home

The Epson Stylus Color 440 connects only via the parallel port and comes bundled with Adobe PhotoDeluxe 2.0, Micrographx's American Greetings CreataCard, StickerPIX Lite, and six month's free access to Disney's Daily Blast Web site. While the 440 is Epson's slowest-rated new printer, in printing an unformatted Microsoft Word document its speed was roughly the same as that of several of the higher-rated models. Overall, it turned in slower-than-average test scores but was within the acceptable range when it comes to entry-level, home-oriented printers.

A little graininess was noticeable in printing photographic images, but considering the Stylus Color 440's low price, this printer is an all-around great deal.

The Epson Stylus Color 660 has a parallel-port interface, but a USB connection kit is available for free via a mail-in coupon. The 660 comes bundled with Arcsoft PhotoPrinter SE and Polaroid PhotoMAX Pro, plus a choice of two sports, game, or graphics software titles (for an additional \$7.95 shipping and handling). The 660's print speed was faster on most tests than the 440, but not on the 12-page unformatted text test. On all the speed tests, the 660 scored below average. Observed print quality was only slightly better on the 660, which says more about the 440 than about the still very good 660.

The Epson Stylus Color 740, bundled with Arcsoft PhotoBase and PhotoPrinter, Dogbyte Greeting Card Store, and Polaroid PhotoMAX, comes standard with both USB and parallel ports built in. This workhorse model is a particularly good buy since, in addition to the choice of interface ports, it also features variable ink droplet sizes, which translates as another step up in photo-printing quality. Speed test results for the 740 were slightly better than for the 660.

For Your Small Office

Starting with the excellent Epson Stylus Color 760, most users would not be able to differentiate between its print quality and that of the higher-numbered Epson models. USB and parallel interfaces are standard. This 4-picoliter-minimum printer does a great job with all printing tasks and again incrementally ups the printing speed. Bundled software includes Arcsoft PhotoPrinter SE, Polaroid PhotoMAX Pro, and a choice of two other titles.

The story with the Epson Stylus Color 860, a relatively fast business printer, is similar to that of the 760: It's a little faster than the next-lower model and does an equally fine job printing text, graphics, and photographic images. While not blazingly fast, the 760 and 860 both offer a combination of speed and quality that should please most small-business or home-office users.

Unless you need the last bit of performance possible from a standard-format ink jet printer, the Stylus Color 860 is a great choice at a great price. Photographic images printed with the 860 are so good that they rival images printed with Epson's photocentric Stylus Photo 750 and 1200 models. USB and parallel interfaces are standard.

The print quality and printing speed performance flagship of Epson's standard-format ink jet printers, the Stylus Color 900 is the printer to choose if you want everything. Adding to the Macintosh compatibility, the Stylus Color 900 has three standard interfaces: parallel, USB, and an 8-pin Macintosh-compatible high-speed serial interface. The 3-picoliter-minimum droplet size from the 900's print-head allows even finer control and greater smoothness in printing photos, though the difference isn't readily noticeable from the next-lower level of Epson printers. The 900's 12-ppm speed rating for black text is also appealing, although on our tests it performed at nearly the same rate as the Stylus Color 860. Intended for professionals, the Stylus Color 900 is bundled with Polaroid PhotoMAX Pro and a coupon for your choice of two software applications.—*Bruce Brown*

HP DeskJet 612C, 812C, 832C, 882C, 895Cse, 970Cse, 2500Cxi

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If you're bewildered by choices among ink jet printers, here's the easy answer: Buy an HP DeskJet. Of course, that only leads to a different problem: Which DeskJet to buy? We report on seven different models in this review, which cover a range of features, performance, and price. They all share at least one trait besides their brand name: excellent output.

The HP DeskJet 612C is for first-time users who don't want to sacrifice quality for price. The HP DeskJet 812C is also intended for home use but is speedier than the 612C. The next step up for home use is the HP DeskJet 832C. The HP DeskJet



With its built-in duplexer, the 970Cse sets a new standard for office ink jets.

882C is aimed at families and home-office applications where extra speed is wanted. The HP DeskJet 895Cse is intended for home office and business applications where performance and versatility count. Each of these choices hits the mark, giving buyers a chance to fine-tune their selection to meet their needs and budgets.

On the professional front, Hewlett-Packard offers the HP DeskJet 970Cse, a superbly designed, well-built printer tar-

geted at businesses. And the HP 2500Cxi is a fast, tabloid-size small-business work-group printer with network capability. What the home-office and business machines have in common is that they performed well above average on our Ink Rundown test.

Home Solutions

Aside from the 612C, the home-oriented printers are peas from the same pod, with the same case and paper handling; the paper tray includes a convenient slot that makes printing envelopes quick and easy. The most obvious differentiating feature between the four is the color of the plastic hatch over the cartridge area. All of the HP printers use a pair of cartridges—one with black ink, and another with cyan, magenta, and yellow ink—but only the 612C takes an optional photo ink cartridge. And the printers share the same quirk: Even though "gray scale only" was selected in the printer driver, they still used some color ink in printing a black-and-white photograph, which often gave the output a cyan tint.

The DeskJet 612C looks like the budget printer that it is. The case is simple, and the paper tray has a guide that helps you feed an envelope through if needed. It is rated for only 1,000 pages a month and has just a 90-day limited warranty. The printer was the slowest of all the HP printers on the speed tests. Despite the slow speed, however, print quality was very good, and photographs had good color. If money is the primary concern, the DeskJet 612C can get the job done.

Most users who are interested in the 612C will probably be happier with the DeskJet 812C. With a faster speed rating, it was above average on the speed tests and was well above average on the Word document tests. It also had much finer color graphics output, with even better photo quality than the 612C. It has the same 1,000-page-per-month duty cycle but comes with a full one-year warranty. Its advantages are well worth the extra \$70.

The next choice in the DeskJet line is the 832C. This model has the same quali-

PRESARIO 5700T-600/3 INTERNET PC		PRESARIO 5700T-550/3 INTERNET PC		PRESARIO 5700T-500/3 INTERNET PC		PRESARIO 5700N-C500 INTERNET PC	
Intel Pentium III Processor, 600 MHz		Intel Pentium III Processor, 550 MHz		Intel Pentium III Processor, 500 MHz		Intel Celeron™ Processor, 500 MHz	
128 MB 100 MHz SyncDRAM expandable to 384 MB		128 MB 100 MHz SyncDRAM expandable to 384 MB		128 MB 100 MHz SyncDRAM expandable to 384 MB		128 MB 100 MHz SyncDRAM, 4 MB Shared for Video	
20.0 GB (7200 rpm) UltraDMA Hard Drive		13.0 GB UltraDMA Hard Drive		13.0 GB UltraDMA Hard Drive		10.0 GB UltraDMA Hard Drive	
10X DVD-ROM Drive ²		10X DVD-ROM Drive ²		32X Max CD-ROM Drive ³		10X DVD-ROM Drive ²	
Creative Labs 3D Blaster 32 MB TNT-2 Ultra Graphics Accelerator		Voodoo 3 1000 2X AGP Graphics Card with 16 MB		Voodoo 3 1000 2X AGP Graphics Card with 16 MB		2X AGP with 64-bit Hardware Accelerated 3D Graphics	
Sound Blaster Live! PCI Audio		Sound Blaster Live! PCI Audio		ESS Solo PCI Audio		ESS Solo PCI Audio	
6.0Mb Max Digital Modem ⁴		56K ITU V.90 Modem ⁵		56K ITU V.90 Modem ⁵		56K ITU V.90 Modem ⁵	
JBL Pro Amplified Speakers		Klipsch v 2-400 Watt Speaker System		JBL Pro Amplified Speakers		JBL Pro Amplified Speakers	
Digital Creativity Imaging Center ⁶		Digital Creativity Imaging Center ⁶		Digital Creativity Imaging Center ⁶		Creativity Action Center	
Microsoft Office 2000 SBE		Microsoft Office 2000 SBE		Home Phoneline Networking ⁷		Microsoft Featured Home Collection	
Microsoft® Word		Microsoft Windows98		Microsoft Featured Home Collection+ MS Word		Microsoft Word	
Microsoft Windows98		Compaq CV715 17" Monitor (16.0" VIA)		Microsoft Windows98		Microsoft Windows98	
Compaq CV915 19" Monitor (18.0" VIA)				Compaq CV715 17" Monitor (16.0" VIA)		Compaq CV715 17" Monitor (16.0" VIA)	
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4X CDRW (Read/Writeable) Drive ⁸ Add \$199		6.0Mb Max Digital Modem ⁵ Add \$99		U750 Color Inkjet Printer Add \$149		6.0Mb Max Digital Modem ⁵ Add \$99	
Home Phoneline Networking ⁷ Add \$39		Microsoft Office 2000 Professional Upgrade Add \$199		4X CDRW (Read/Writeable) Drive Add \$199		JBL Pro Premium Speakers w/ Subwoofer Add \$49	
Klipsch v 2-400 Watt Speaker System Add \$224		4X CDRW (Read/Writeable) Drive Add \$199		Intel Create and Share Camera Pack Add \$99		APC Back-UPS Pro Office 280 Add \$89	

PRESARIO 1900T-P11 400 INTERNET NOTEBOOK PC		PRESARIO 1800T-P11 366 INTERNET NOTEBOOK PC		PRESARIO 1900T-P11 366 INTERNET NOTEBOOK PC		PRESARIO 1800T-C466 INTERNET NOTEBOOK PC	
Intel Mobile Pentium II Processor, 400 MHz		Intel Mobile Pentium II Processor, 366 MHz		Intel Mobile Pentium II Processor, 366 MHz		Mobile Intel Celeron 466 MHz Processor	
13.3" TFT Active Matrix Display		14.1" TFT Active Matrix Display		13.3" TFT Active Matrix Display		15.0" TFT Active Matrix Display	
128 MB SyncDRAM		128 MB SyncDRAM		128 MB SyncDRAM		64 MB SyncDRAM	
10.0 GB UltraDMA Hard Drive		10.0 GB UltraDMA Hard Drive		6.4 GB UltraDMA Hard Drive		4.8 GB UltraDMA Hard Drive	
6X DVD-ROM Drive ⁹		24X Max CD-ROM Drive ⁹		6X DVD-ROM Drive ⁹		24X Max CD-ROM Drive ⁹	
ATI Mobility Hardware Accelerated 3D Graphics with 8 MB Video Memory		ATI Rage LT Pro Hardware Accelerated 3D Graphics with 8 MB Video Memory		ATI Mobility Hardware Accelerated 3D Graphics with 8 MB Video Memory		ATI Rage LT Pro Hardware Accelerated 3D Graphics with 8 MB Video Memory	
56K ITU V.90 Modem (PCI) ⁵		56K ITU V.90 Modem (PCI) ⁵		56K ITU V.90 Modem (PCI) ⁵		56K ITU V.90 Modem (PCI) ⁵	
Ultra Hi-Capacity Lilon Battery		Ultra Hi-Capacity Lilon Battery		Ultra Hi-Capacity Lilon Battery		Ultra Hi-Capacity Lilon Battery	
256 KB Integrated "On-chip" cache		256 KB Integrated "On-chip" cache		256 KB Integrated "On-chip" cache		128 KB Integrated "On-chip" cache	
Microsoft Featured Home Collection		Tripp Lite 140 Watt Inverter		Microsoft Featured Home Collection		Tripp Lite 140 Watt Inverter	
Microsoft Windows98		Microsoft Featured Home Collection		Microsoft Windows98		Microsoft Featured Home Collection	
		Microsoft Windows98				Microsoft Windows98	
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QuickDock w/Integrated Ethernet Add \$129		6X DVD-ROM Drive ⁹ Add \$150		QuickDock w/Integrated Ethernet Add \$129		6.4 GB UltraDMA Hard Drive Add \$100	
Compaq Global II Case Add \$89		QuickDock Add \$99		Extra AC Adapter Add \$49		QuickDock Add \$99	
Extra Ultra Hi-Capacity Lilon Battery Add \$129		Compaq Value Case Add \$39		Extra Ultra Hi-Capacity Lilon Battery Add \$129		128 MB SyncDRAM Add \$200	

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For Your Small Office

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Home Solutions

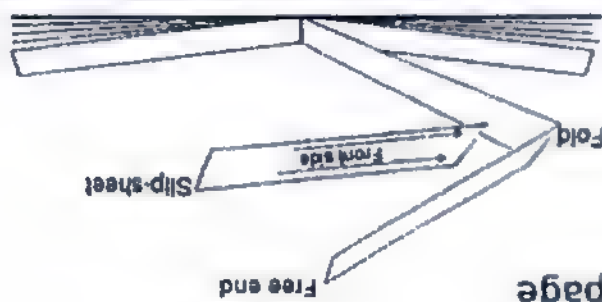
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128 MB 100 MHz SyncDRAM expandable to 384 MB		128 MB 100 MHz SyncDRAM expandable to 384 MB		128 MB 100 MHz SyncDRAM expandable to 384 MB		128 MB 100 MHz SyncDRAM, 4 MB Shared for Video	
20.0 GB (7200 rpm) UltraDMA Hard Drive		13.0 GB UltraDMA Hard Drive¹		13.0 GB UltraDMA Hard Drive¹		10.0 GB UltraDMA Hard Drive¹	
10X DVD-ROM Drive²		10X DVD-ROM Drive²		32X Max CD-ROM Drive³		10X DVD-ROM Drive²	
Creative Labs 3D Blaster 32 MB TNT-2 Ultra Graphics Accelerator		Voodoo 3 1000 2X AGP Graphics Card with 16 MB		Voodoo 3 1000 2X AGP Graphics Card with 16 MB		2X AGP with 64-bit Hardware Accelerated 3D Graphics	
Sound Blaster Live! PCI Audio		Sound Blaster Live! PCI Audio		ESS Solo PCI Audio		ESS Solo PCI Audio	
6.0Mb Max Digital Modem⁴		56K ITU V.90 Modem³		56K ITU V.90 Modem³		56K ITU V.90 Modem³	
JBL Pro Amplified Speakers		Klipsch v.2-400 Watt Speaker System		JBL Pro Amplified Speakers		JBL Pro Amplified Speakers	
Digital Creativity Imaging Center¹		Digital Creativity Imaging Center¹		Digital Creativity Imaging Center¹		Creativity Action Center	
Microsoft Office 2000 SBE		Microsoft Office 2000 SBE		Home Phoneline Networking¹		Microsoft Featured Home Collection	
Microsoft® Word		Microsoft Windows98		Microsoft Featured Home Collection+ MS Word		Microsoft Word	
Microsoft Windows98		Compaq CV715 17" Monitor (16.0" VIA)		Microsoft Windows98		Microsoft Windows98	
Compaq CV915 19" Monitor (18.0" VIA)				Compaq CV715 17" Monitor (16.0" VIA)		Compaq CV715 17" Monitor (16.0" VIA)	
\$2399[†] As low as \$67 per month¹		\$1999[†] As low as \$56 per month¹		\$1399[†] As low as \$39 per month¹		\$1199[†] As low as \$34 per month¹	
4X CDRW (Read/Writeable) Drive¹ Add \$199		6.0Mb Max Digital Modem⁴ Add \$99		I750 Color Inkjet Printer Add \$149		6.0Mb Max Digital Modem⁴ Add \$99	
Home Phoneline Networking¹ Add \$39		Microsoft Office 2000 Professional Upgrade¹ Add \$199		4X CDRW (Read/Writeable) Drive Add \$199		JBL Pro Premium Speakers w/Subwoofer Add \$49	
Klipsch v.2-400 Watt Speaker System Add \$224		4X CDRW (Read/Writeable) Drive¹ Add \$199		Intel Create and Share Camera Pack Add \$99		APC Back-UPS Pro Office 280 Add \$89	



1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet

Inverted Foldout slip-sheet

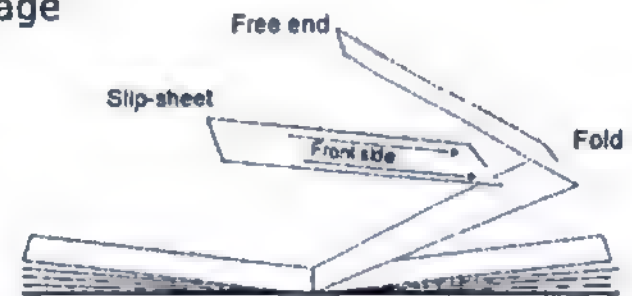


GbsSlipSheet-001

Folded edge of the page

Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



1. Follow instructions on the other side

Inverted Back



GbsSlipBack-0018

Back

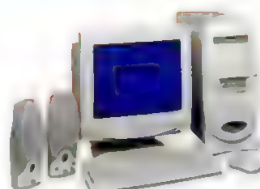
1. Follow instructions on the other side

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SUMMARY OF FEATURES

Ink Jet Printers

■ YES □ NO	ALPS MD-5000	Brother MP-21Cdx	Canon BJC-50	Canon BJC-80	Canon BJC-1000	Canon BJC-2000	Canon BJC-5100	Canon BJC-6000
Street price	\$600	\$350	\$350	\$300	\$50	\$70	\$150	\$200
Number of colors used in color/photo mode	4/4	4/4	3/4	3/4	3/3	3/4	3/4	3/4
Dimensions (HWD, in inches)	7.5 x 18.2 x 11.5	4.2 x 11.8 x 2.0	1.9 x 11.8 x 4.4	2.2 x 11.8 x 6.2	6.4 x 14.1 x 7.0	8.0 x 14.4 x 7.4	8.7 x 19.6 x 11.0	8.2 x 19.4 x 11.4
Weight (pounds)	11.0	2.2	2.0	3.1	4.8	5.3	11.6	13.0
Rated engine speeds: draft mode (monochrome/color, in ppm)	N/A/N/A	2.5/2.0	5.5/2.0	4.5/2.0	4.0/0.6	5.0/2.0	10.0/4.0	8.0/5.0
Rated engine speeds: best mode (monochrome/color, in ppm)	2.0/0.2	Info not available	Info not available	Info not available	Info not available	Info not available	Info not available	Info not available
Monochrome resolution in best mode	600 x 600	720 x 720	720 x 360	720 x 360	720 x 360	720 x 360	1,440 x 720	1,400 x 720
Color resolution in best mode	600 x 600	720 x 720	720 x 360	720 x 360	720 x 360	720 x 360	1,440 x 720	1,400 x 720
Parallel port/Serial port/USB port	■ □ ■	■ □ □	■ □ □	■ □ □	■ □ □	■ □ □	■ □ □	□ □ □
IEEE 1284 cable included	□	■	□	□	□	□	□	□
Input/output tray capacity (sheets)	100/N/A	30/N/A	30/30	30/30	50/50	50/50	130/130	130/130
Envelope input capacity	N/A	1	5	5	5	5	5	15
Heaviest paper (pounds)	110	42	30	30	30	30	140	143
Prints on card stock/transparencies/labels	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Prints on tabloid-size paper (11" x 17")	□	□	□	□	□	□	■	□
Maximum banner length (inches)	N/A	N/A	N/A	N/A	51	51	51	52
Watermark/booklet printing	□ □	□ □	□ □	□ □	■ □	■ ■	□ □	■ ■
Cost of high-capacity black ink cartridge	\$6.99	\$31.99	\$38.00	\$38.00	\$31.95	\$37.00	\$37.00	\$38.00
Cost per color cartridge	\$6.99	\$31.99	\$45.00	\$45.00	\$38.95	\$53.00	\$53.00	\$43.00
Separate cartridge for each color	■	□	■	■	■	■	■	■
Stops printing if one color runs out	■	□	□	□	□	□	□	□
Rated cost per page, 5% black coverage	2.4 cents	6.4 cents	5 cents	5 cents	6 cents	4 cents	4 cents	3 cents
Rated cost per page, 15% color coverage	34 cents	27.6 cents	17 cents	17 cents	13 cents	16 cents	16 cents	9 cents
Application software included	None	None	None	None	Canon Creative Home	Canon Creative Home	Canon Creative Home	Canon Creative Home
Live technical support (eastern time)	24 hours, 7 days	24 hours, 7 days	8:00a-10:00p M-F, noon-6:00 Sat.	8:00a-10:00p M-F, noon-6:00 Sat.	8:00a-10:00p M-F, noon-6:00 Sat.	8:00a-10:00p M-F, noon-6:00 Sat.	8:00a-10:00p M-F, noon-6:00 Sat.	8:00a-10:00p M-F, noon-6:00 Sat.
Warranty	1 year	1 year	1 year	1 year	1 year	1 year	1 year	1 year
Overnight exchange under warranty	□	■	□	□	□	□	□	□

N/A—Not applicable: The product does not have this feature.

ty of output and speed as the 812C and comes with the same software bundle: HP Instant Delivery, HP Printing Expressions, HP WebPrintSmart, Juno, and access to Disney's Daily Blast Web site. Like the 812C, it also has a USB port in addition to the parallel port. The only substantive difference between the two is that the 832C uses larger-capacity ink cartridges and, as a result, runs longer without maintenance.

The DeskJet 882C is rated a half-page-per-minute faster than the previous two models and also has a USB port. The printer is well suited for either home or office use, but the extensive bundle of family-oriented graphics and project software is certain to appeal more to home users. The printer was well above average in print

speed and, like its stablemates, produced excellent output. It is a no-compromise choice for family use at an attractive price.

Getting Down to Business

The DeskJet 895Cse is the first rung in HP's Professional Series product ladder. It is rated for 3,000 pages per month—50 percent more than the 882C—and comes with a useful set of software add-ons, including Office in Color, which works with Microsoft Office. The printer performed well in print quality and speed all across our test suite. It includes a USB port in addition to its parallel port. The combination of fast performance and the software bundle makes it an attractive value for business office settings.

While its ability to print excellent busi-

ness-quality text and graphics is compelling, what really distinguishes the 970Cse is that it's the first desktop printer in its class to offer full automatic duplexing.

Although the 970Cse isn't a photo printer, nevertheless we were impressed with its photo-quality output. Images were sharp and bright, with good detail in both highlights and shadows. Text was crisp and clean, and there was no bleed when printed double-sided. While the single-page printing speed was a little below average, the 970Cse made up for it when outputting multiple-page documents.

Everything about the 970Cse shouts quality. HP's REt III color-layering technology boosts resolution to 1,200-by-2,400. The unit can be upgraded to network capability. It uses new inks formulated for

Continues

Compaq LJ300	Compaq LJ750	Epson Stylus Color 440	Epson Stylus Color 660	Epson Stylus Color 740	Epson Stylus Color 760	Epson Stylus Color 860	Epson Stylus Color 900	HP DeskJet 612C	HP DeskJet 812C
\$100	\$150	\$80	\$130	\$200	\$230	\$280	\$400	\$100	\$150
3/3	3/4	4/4	4/4	4/4	4/4	4/4	4/4	4/6	4/4
6.1 x 14.7 x 8.4	11.0 x 18.1 x 8.0	6.1 x 16.9 x 9.1	6.1 x 16.9 x 9.1	6.6 x 17.1 x 11.5	11.3 x 17.2 x 14.7	11.5 x 17.7 x 15.2	12.8 x 18.4 x 11.7	7.9 x 17.2 x 16.0	7.3 x 17.5 x 14.0
4.0	8.8	11.5	11.5	11.5	12.8	13.2	18.5	11.6	12.5
4.0/2.0	7.0/3.5	4.0/2.5	5.0/3.5	6.0/5.0	7.0/6.0	9.5/7.0	12.0/10.0	5.0/2.5	6.5/4.5
Info not available	Info not available	Info not available	Info not available	Info not available	Info not available	Info not available	Info not available	1.0/0.3	4.0/0.8
1,200 x 1,200	1,200 x 1,200	720 x 720	1,440 x 720	1,440 x 720	1,440 x 720	1,440 x 720	1,440 x 720	600 x 600	600 x 600
1,200 x 1,200	1,200 x 1,200	720 x 720	1,440 x 720	1,440 x 720	1,440 x 720	1,440 x 720	1,440 x 720	600 x 300	Info not available
■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
□	□	□	□	□	□	□	□	□	□
100/25	100/25	100/30	100/30	100/30	100/30	100/30	100/30	100/50	100/50
10	10	10	10	10	10	10	10	20	15
150	150	52	52	52	52	52	52	24	24
■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
□	□	□	□	□	□	□	□	□	□
220	220	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited	N/A	11
□ □	□ □	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ N/A	■ (with Mac driver only) □
\$32.99	\$32.99	\$25.00	\$25.00	\$30.00	\$30.00	\$30.00	\$33.00	\$27.00	\$29.00
\$39.99	\$39.99	\$30.00	\$30.00	\$30.00	\$30.00	\$30.00	\$40.00	\$29.59	\$33.27
□	□	□	□	□	□	□	□	□	□
□	□	■	■	■	■	■	■	□	□
Info not available	Info not available	6.5 cents	6.5 cents	4.5 cents	4.5 cents	4.5 cents	4 cents	8 cents	7 cents
Info not available	Info not available	10 cents	10 cents	10 cents	10 cents	10 cents	7 cents	9.6 cents	4.8 cents
ArcSoft Photo-Printer V2.0LE; coupon for two more programs	ArcSoft Photo-Printer V2.0LE; Corel Print House Magic 4.0 Select; coupon for two more programs	Adobe Photo-Deluxe 2.0, American Greetings CreatiCard, StickerPix Lite, Disney's Daily Blast (6 months' access)	ArcSoft PhotoPrinter SE, Polaroid PhotoMAX Pro, coupon for two more programs	ArcSoft PhotoPrinter and PhotoBase, DogByte Greeting Card Store, Polaroid PhotoMAX Pro	ArcSoft PhotoPrinter SE, Polaroid PhotoMAX Pro, coupon for two more programs	ArcSoft PhotoPrinter SE, Polaroid PhotoMAX Pro, coupon for two more programs	Polaroid PhotoMAX Pro, coupon for two more programs	Disney's Daily Blast, HP Instant Delivery, HP Printable Expressions	HP Instant Delivery, HP Printable Expressions
24 hours, 7 days	24 hours, 7 days	9:00–9:00 M–F	9:00–9:00 M–F	9:00–9:00 M–F	9:00–9:00 M–F	9:00–9:00 M–F	9:00–9:00 M–F	8:00a–midnight M–F, 11:00–6:00 Sat.	8:00a–midnight M–F, 11:00–6:00 Sat.
1 year	1 year	1 year	1 year	1 year	1 year	1 year	1 year	1 year	90 days
■	■	■	■	■	■	■	■	■ (for a fee)	■ (for a fee)

stability and vibrancy. The 970Cse has a robust duty cycle and is so quiet that you're not even certain when it's printing. Its most outstanding feature is a built-in automatic duplexer, which makes printing double-sided copy virtually effortless. It worked flawlessly during our tests, never jamming or missing a page.

Undoubtedly, there will be many instantly indispensable uses for high-quality duplex printers. Already, HP's new Web site, to which the printer driver automatically connects, can download and format double-sided printouts of newspapers or magazines.

The HP 2500Cxi features huge ink reservoirs, a 12,000-copy-per-month duty cycle, and dual paper trays. With its network option, this may turn out to be the

only printer a wired office needs.

The printer achieves stunning image quality, due in great part to the print engine, which employs separate printheads and ink cartridges, as well as HP's REt II image enhancement technology. Even though it has no special photo inks, colors were excellent and skin tones accurate, though slightly oversaturated. Images were crisp and detailed, and gradients were smooth, with impressive detail in shadows and highlights. Text output was among the best we've seen in an ink jet. It was also among the fastest ink jets we tested.

Installation and setup are surprisingly easy, as is normal operation. Jams are rare, and the paper path can be easily cleared. Instead of selecting resolutions, the user simply specifies the kind of output

desired—Best, Normal, or EconoFast—as well as the size and type of media. It can accommodate up to 13- by 19-inch paper, but while it offers a PostScript option, the 2500Cxi is not a professional graphics printer and has no real halftone or color correction tools.—*DG, SWG, and AP*

Lexmark Z11, Z31, Z51

Z11: 4 ppm monochrome/2.5 ppm color; 600 x 600. \$50. **Z31:** 8 ppm mono/3.5 ppm color; 1,200 x 1,200. \$200. **Z51:** 10 ppm mono/5 ppm color; 1,200 x 1,200. \$250. Lexington, KY; 888-539-6275; www.lexmark.com.

● How much lower can printer prices go? The Lexmark Z11 is a color printer that sells for so little that many manufacturers bundle it with every computer sale. What's more amazing is that the Z11 produces surprisingly good output.

SUMMARY OF FEATURES

Ink Jet Printers



	HP DeskJet 832C	HP DeskJet 852C	HP DeskJet 895Cse	HP DeskJet 970Cse	HP 2500Cxi	Lexmark Z11	Lexmark Z31
Street price	\$200	\$250	\$300	\$380	\$1,000	\$50	\$150
Number of colors used in color/photo mode	4 / 4	4 / 4	4 / 4	4 / 4	4 / 4	3 / N/A	3 / 6
Dimensions (HWD, in inches)	7.3 x 17.5 x 14.0	7.3 x 17.5 x 14.0	7.3 x 17.5 x 14.0	7.7 x 17.3 x 14.8	13.3 x 27.0 x 24.0	6.1 x 8.4 x 14.7	13.7 x 11.2 x 19.5
Weight (pounds)	12.5	12.5	12.0	12.9	59.5	4.0	8.0
Rated engine speeds: draft mode (monochrome/color, in ppm)	8.0 / 5.0	9.0 / 6.5	11.0 / 8.5	12.0 / 10.0	11.0 / 9.0	4.0 / 2.5	8.0 / 3.5
Rated engine speeds: best mode (monochrome/color, in ppm)	4.0 / 0.8	4.3 / 1.0	4.4 / 1.0	4.7 / 3.1	7.5 / 1.5	Info not available	Info not available
Monochrome resolution in best mode	600 x 600	600 x 600	600 x 600	600 x 600	600 x 600	1,200 x 1,200	1,200 x 1,200
Color resolution in best mode	Info not available	Info not available	Info not available	Info not available	Info not available	1,200 x 1,200	1,200 x 1,200
Parallel port/Serial port/USB port	■ □ ■	■ □ ■	■ □ ■	■ □ ■	■ □ □	■ □ □	■ □ □
IEEE 1284 cable included	□	□	□	□	□	□	□
Input/output tray capacity (sheets)	100 / 50	100 / 50	100 / 50	150 / 50	400 / 150	100 / 25	100 / 25
Envelope input capacity	15	15	15	15	N/A	10	10
Heaviest paper (pounds)	24	24	24	24	110	150	180
Prints on card stock/transparencies/labels	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Prints on tabloid-size paper (11" x 17")	□	□	□	□	□	■	■
Maximum banner length (inches)	11	11	11	11	N/A	220	220
Watermark/booklet printing	■ (with Mac driver only) □	■ (with Mac driver only) ■	■ (with Mac driver only) ■	■ (with Mac driver only) ■	■ □	□ □	□ □
Cost of high-capacity black ink cartridge	\$28.79	\$28.79	\$28.79	\$28.79	\$29.99	\$35.00	\$35.00
Cost per color cartridge	\$33.27	\$33.27	\$33.27	\$33.59	\$29.99	\$36.00	\$36.00
Separate cartridge for each color	□	□	□	□	■	□	□
Stops printing if one color runs out	□	□	□	□	■	□	□
Rated cost per page, 5% black coverage	3.5 cents	3.5 cents	3.5 cents	3.5 cents	2.5 cents	Info not available	Info not available
Rated cost per page, 15% color coverage	4.8 cents	4.8 cents	4.8 cents	7.0 cents	5.2 cents	Info not available	Info not available
Application software included	Disney's Daily Blast, HP Instant Delivery, HP Printable Expressions, HP Web PrintSmart, Juno	Disney's Daily Blast, HP Instant Delivery, HP Printable Possibilities, Microsoft Picture It! Express, Print-Master Gold Publishing Suite	HP Instant Delivery, HP PhotoRecall, HP Printing Essentials for Home and Office, HP Web PrintSmart, Microsoft Internet Explorer, Office in Color	By Design Office, HP Instant Delivery, HP FontSmart, HP Web PrintSmart, Office in Color	None	Lexmark Color Printing Software	Corel Print House Magic
Live technical support (eastern time)	8:00a-midnight M-F, 11:00-6:00 Sat.	8:00a-midnight M-F, 11:00-6:00 Sat.	8:00a-midnight M-F, 11:00-6:00 Sat.	8:00a-midnight M-F, 11:00-6:00 Sat.	8:00-8:00 M-F	9:00-9:00 M-F, noon-6:00 Sat., Sun.	9:00-9:00 M-F, noon-6:00 Sat., Sun.
Warranty	1 year	1 year	1 year	1 year	1 year	1 year	1 year
Overnight exchange under warranty	■ (for a fee)	■ (for a fee)	■ (for a fee)	■ (for a fee)	■	■	■

N/A—Not applicable. The product does not have this feature.

The Z11's colors are oversaturated and not realistic, but they can be pleasing. Text output was slightly flat but otherwise acceptable. We experienced minor problems with registration, but they cleared up after we aligned the cartridge a second time. Our gray-scale image, although somewhat tinged with mauve, had better details and a smoother gradient than images from printers costing much more. The Z11 boasts an image-enhanced resolution of 1,200 by 1,200 dpi, but we found no significant quality difference between that and the 600-by-600 (default) resolution. Not surprisingly, the Z11 is a slow-

poke: It was near the bottom of the pack on our speed tests.

One click launches the automated setup program; using the printer is very simple and nearly foolproof. The single cartridge is extremely simple to install, and the status report accurately shows how much ink is left. Lexmark bundles a CD with ten programs, any two of which the user can install, gratis. The company's LexExpress warranty ensures that if the Z11 (as well as the Z31 or Z51) fails in the first year, Lexmark will send a replacement printer overnight.

The Z31 is designed for family and

home-office use. It delivers very good image quality, but its drifting head alignment may put off more demanding users. Z31 output on plain paper exhibits vibrant, accurate colors, though they tend to be slightly oversaturated when printed on glossy paper. Though our gray-scale test print showed smooth tonality in transitions from dark to light, the Z31 can't print true gray-scale photos in best-resolution mode. That's because although the interface allows a 1,200-by-1,200 resolution, selecting gray scale instead of color automatically reduces the resolution to 600-by-600. Also, our test image had a

Ends

Lexmark Z51	Xerox DocuPrint C8	Xerox DocuPrint C11
\$200	\$100	\$200
3 / 6	4 / 4	4 / 4
8.8 x 18.1 x 11.5	10.7 x 17.1 x 13.3	6.7 x 17.0 x 8.3
9.0	9.9	13.2
100 / 5.0	50 / 2.5	90 / 5.0
Info not available	Info not available	Info not available
1,200 x 1,200	1,200 x 600	600 x 600
1,200 x 1,200	1,200 x 600	1,200 x 1,200
100 / 25	100 / 50	100 / 60
10	1	1
150	43	
220	N/A	N/A
\$35.00	\$29.00	\$33.00
\$37.00	\$12.00	\$40.00
Info not available	6.7 cents	3.6 cents
Info not available	9.2 cents	7.9 cents
Corel Print House Magic	Net Zero, LivePix 2.0	Net Zero, LivePix 2.0
9:00-9:00 M-F noon-6:00 Sat. Sun	8:00-8:00 M-F, 11:00-3:00 Sat.	8:00-8:00 M-F, 11:00-3:00 Sat.
1 year	1 year	1 year

dark mauve cast in the light areas. Print speed was slightly above average.

Lexmark's logical interface and excellent documentation let even novices navigate through the variety of manual parameter settings easily. Even so, we achieved our best-quality printing in the default mode. The Z31's one persistent problem is head alignment; the registration drifted very slightly, despite repeated calibration, replacement of ink cartridges, and testing on a second machine. This drift was not significant for most output, but it can affect graphics that require precise line and color placement. Although the

Lexmark Z31 fills most family and home-office needs, it is a bit more expensive than comparable printers by HP or Epson.

Unlike many ink jets that can output only photos at the highest resolution, the Lexmark Z51 can print excellent text, graphics, and photos at its best-quality setting. Its ability to generate great text and images, as well as work with a variety of media and page formats, is certain to appeal to business users. Despite its vaunted speed rating, our tests indicated that the Z51 was slower than average, even when connected through USB.

We were very pleased with most of the Z51's print quality. Whether using standard or photo cartridges, colors were accurate and lush without being oversaturated. As expected with an engine capable of laying down tiny 7-picoliter ink droplets, detail was well defined. Text was very black, sharp, and clean. But it did produce minor banding in gradients and couldn't produce true blacks on our gray-scale photo test.

As befits a business printer, the Z51's driver allows easy setup and output for manual duplexing, handouts, booklets, posters, and page ordering. It also accommodates many different media grades and weights, including stiff card stock and banner paper.

Great output, versatile paper and format handling, and a strong duty cycle make the Z51 a strong contender among business users.—*DG and SWG*

Xerox DocuPrint C8, C11

C8: 2.5 ppm monochrome/5 ppm color; 600 x 600. \$100. **C11:** 5 ppm mono/9 ppm color; 1,200 x 1,200. \$200 street. Webster, NY; 800-832-6979; www.xerox.com.

● At \$100, the Xerox DocuPrint C8 will appeal to home users, especially students. It's easy to set up and operate, and print quality is very good, though performance is somewhat sluggish.

The C8 incorporates four separate ink cartridges and a single printhead. Although no photo cartridges are available, the colors on our test image were richly saturated and pleasing—but inaccurate. They looked sharp despite the C8's very large 92-picoliter size. We printed photos in both 600-by-600 and image-enhanced 1,200-by-600 modes but detected no discernable quality difference. Text was crisp and accurate, down to 6 points. The C8

was poorly on our gray-scale test, however, exhibiting an annoying textured pattern rather than seamless transitions between light and dark. And the C8 was quite slow, though its 512K buffer helps speed a return to your application.

Novices and even children will have no difficulty using Xerox's simple step-by-step installation wizard. Similarly, the interface is uncomplicated and easy to use. Parameters are set according to the type of media and printing mode selected. In addition to standard page formatting, users can output images in poster mode (which stitches pages together to form a single image) or in duplex mode (printing multiple images on the same page).

The C8 comes bundled with LivePix 2.0 and a one-year, overnight-exchange service warranty.

Costing twice as much as the C8, the SOHO-oriented Xerox DocuPrint C11 offers better resolution, a faster print speed, and more accurate color. It is, however, slower than the competition—despite a large 2MB buffer.

The C11 is also a four-cartridge color system, but it incorporates two heads and can accommodate a separate photo cartridge. This, as well as true 1,200-by-1,200 resolution and a smaller 25-picoliter ink drop size, helped produce sharper, more realistic colors that were bright without being oversaturated. Gradients were smoother than those from the C8, though they exhibited minor banding. Selecting the C11's Vivid Color over the default Intelligent Color pumps up the saturation for colorful business graphics. Type was readable down to 6 points, but registration wasn't as good as the C8's. Because the ink reservoirs are significantly larger than those in the C8, the cost per page is less and the cartridges do not need to be replaced as often.

Installation and setup are trouble-free. Its interface offers more choices and combinations than the C8's, including three types of halftones. Even so, it lacks the sophistication of some printers in its class. And the C11 is noisy; it sounds like a muffled washing machine.

The C11 is not particularly innovative or feature-rich. But it's still an attractive choice for neophytes and small businesses that value its simplicity, reliability, and consistently good output.—*DG and SWG*

laser printers

Brother HL-1240, HL-1250

HL-1240: 12 ppm monochrome; 600 x 600. \$300 street.
HL-1250: 12 ppm mono; 1,200 x 600. \$400. Bridgewater, NJ; 800-521-2846; www.brother.com.

● The Brother HL-1240 and HL-1250 set a new standard for desktop monochrome lasers. They're smaller, much faster, and more versatile than other printers in their class. Although Brother positions both printers as family devices, they're far better suited for small offices that require an inexpensive, reliable workhorse.

The HL-1240 prints at 600-by-600 and comes with 2MB of memory, which is not expandable. Even so, the printer was able to output our 8MB gray-scale image without bombing, though contrast was reduced and gradients were indistinct. Type was crisp, clean, and well formed, in part because of smaller-size ink droplets.

The HL-1250 can print at 1,200-by-600 and comes with 4MB of RAM, which you can expand to 36MB. These specs helped produce only marginally superior output; type was similarly well formed and black, while our gray-scale image had greater contrast and definition. But the HL-1250 can accommodate an optional 250-sheet second paper tray—a boon for business users but less helpful at home.

Both printers output an honest 12 ppm, and both can kick out the first print in 15 seconds. The printers connect to parallel or USB ports, and they work on PCs and Macs. Neither printer has network capability, but their heavy duty cycle promises trouble-free day-to-day operation.—*DG and SWG*

HP LaserJet 1100xi, 2100TN

1100xi: 8 ppm monochrome; 600 x 600. \$400 street. **2100TN:** 10 ppm mono; 1,200 x 1,200. \$1,000. Palo Alto, CA; 800-752-0900; www.hp.com.

● The entry-level HP LaserJet 1100xi will be a welcome addition to small- and home-office users who want speed, reliability, and a small footprint at a modest price. Though it has a somewhat small paper capacity, the 1100xi delivers impressive text quality.

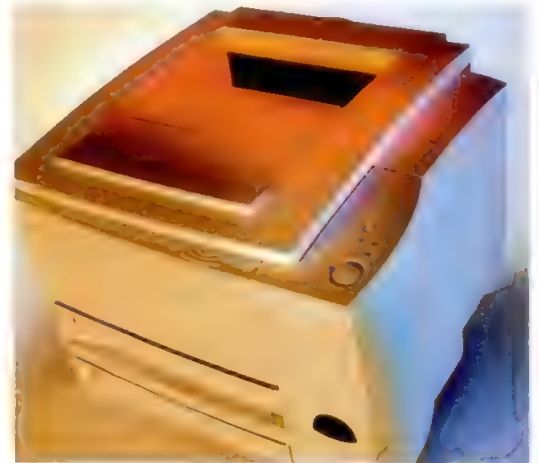
HP's resolution enhancement technology produces sharp, black, clean text; this output is as good as that from a 1,200-dpi laser printer. The unit can print gray-scale graphics, but its limited 2MB memory (upgradable to 18MB) translates into noisy, flat images. Our speed tests averaged an effective printing speed of 7.8 ppm on the 12-page formatted and unformatted text documents.

Users have a variety of options and settings in the interface, including *n*-up, manual duplexing, and watermarking. Although you can equip the 1100xi with an optional network connection, the paper tray holds only 125 sheets, which is hardly enough for a typical office. A \$149 option turns the 1100xi into a sheet-fed scanner, though flatbed scanners are better and less expensive. The 1100xi's toner cartridge is good for about 2,500 pages, with an average cost of 2.2 cents per sheet—the most expensive of any HP LaserJet. With a duty cycle of 7,000 pages per month, the 1100xi should meet the demands of most small offices.

The HP LaserJet 2100TN is a loaded office printer

that has it all: network capability, PostScript emulation, superb output, dual paper trays, moderate speed, a duty cycle of 15,000 copies per month, and a low cost per page for consumables.

By printing in PostScript emulation mode (which automatically sets the resolution at 1,200 dpi) and using HP's high-capacity UltraPrecise toner cartridge, you can approach professional typesetting quality with the 2100TN. In an informal trial, our reviewers printed out a gray-



The 2100TN accepts a 5,000-page toner cartridge, which cost 2.2 cents per page.

scale test image, which exhibited impressive tonality, with excellent details in the shadows and highlights. Printing speed averaged 9 ppm in Word documents.

The 2100TN can be installed as a parallel or network printer (or both). USB is optional with this model, and it requires



LASER PRINTERS

	Street price	Text quality	Graphics quality	Overall speed	Service and Reliability grade*
Brother HL-1240	\$300	Good	Fair	Excellent	D
Brother HL-1250	\$400	Good	Good	Excellent	D
HP LaserJet 1100xi	\$400	Excellent	Good	Fair	A
HP LaserJet 2100TN	\$1,000	Excellent	Excellent	Good	A
Kyocera Ecocys FS-1200	\$800	Excellent	Good	Fair	—
Lexmark Optra E310	\$400	Good	Poor	Poor	B
NEC SuperScript 870	\$350	Excellent	Good	Good	—
custom copies NEC SuperScript 1800	\$800	Excellent	Good	Excellent	—
Okidata OkiPage 10e	\$300	Excellent	Fair	Fair	C
Okidata OkiPage 12i	\$600	Excellent	Fair	Fair	C
QMS imagicolor 2 DeskLaser	\$399**	Excellent	Good	Excellent	D
Samsung QwikLaser 6000	\$850	Good	Excellent	Good	—
Xerox DocuPrint P15x	\$400	Excellent	Good	Fair	B
Xerox DocuPrint P1202	\$700	Excellent	Good	Good	B

* PC Magazine, July 1999. A dash indicates that the vendor was not represented in our published survey results.

** List price



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PERFORMANCE TESTS

Laser Printers



With its 17-ppm-rated print engine, the NEC SuperScript 1800 outclassed the field of laser printers. The 12-ppm Brother HL-1250 could not compete in the raw engine speed, but it was superior in processing graphics-intensive documents.

In most cases, we found that the desktop laser printers' performance tracked fairly closely with their page-per-minute ratings when printing a large job. But raw ppm alone does not tell the whole story. Desktop printers do not always print 50-page reports. In fact, most common jobs consist of only a few pages. We measured how quickly each printer could print a single page as well as its sustained speed when printing a multipage job. We also looked at how fast a printer driver returned the application control to the user.

With the new suite of test targets we used, the performance numbers in this roundup are not comparable to last year's data.

field in this roundup, which consisted mostly of printers rated at 10 ppm and 12 ppm. Not far behind were the two Brother printers, the HL-1250 and HL-1240, which came within 2 percent of their rated 12-ppm engine speed on the same test. In some graphics-intensive jobs, like the 3 pages of text and graphs and 2 Web pages, the HL-1250 even outperformed the NEC SuperScript 1800.

When it came to printing short documents, the Kyocera Ecosys FS-1200 and the Xerox DocuPrint P1202 were not far behind the leaders. These printers demonstrated bursts of speed that let them produce 1-page documents with little start-up latency.

How We Tested

For measuring the performance of personal laser printers, we executed the speed tests described in the ink jet section.

For laser printers, we added the **42 pages, formatted text** test, for which we measure the time it takes to print a 42-page Word 97 document that is similar in content to the 12-page formatted-text document.

As with the ink jet printers, we set the laser printers' drivers to 600 dpi, or as close to it as possible, in text and graphics mode. We measured the *click-to-clunk time*, which we define as the duration from the moment you click the OK button in the print dialog box to the moment the last page is released to the output tray. In the chart, we present the data in *effective pages per minute*—a calculation based on the click-to-clunk time, which includes the first-page-out delay before each job.—*Analysis written by S. Jae Yang. Special thanks to Pete Duff and Ken Kim of QualityLogic.*

Effective ppm										
High scores are best.										
Bold type denotes first place.										
Printer	Rated engine speed (ppm)	1-page letter	12 pages, unformatted text	12 pages, formatted text	42 pages, formatted text	1-page table	3 pages, text and graphs	1-page graph	Netscape Navigator 4 2 Web pages	Microsoft PowerPoint 97 12 pages, slides
Brother HL-1240	12	4.2	10.3	10.7	12.0	4.0	4.1	3.8	2.9	10.1
Brother HL-1250	12	2.4	9.7	10.4	11.8	3.6	4.4	3.7	3.3	10.8
HP LaserJet 1100xi	8	3.1	7.8	7.8	6.8	2.6	0.9	2.3	0.9	1.0
HP LaserJet 2100TN	10	3.3	8.5	8.6	9.0	2.8	1.5	2.2	1.7	1.8
Kyocera Ecosys FS-1200	12	4.0	10.0	10.8	10.6	4.0	3.4	4.0	3.4	2.4
Lexmark Optra E310	8	2.4	7.0	N/A	5.5	3.4	1.4	2.1	0.6	1.5
NEC SuperScript 870	8	3.3	7.0	7.3	7.7	3.3	N/A	2.1	1.5	4.8
NEC SuperScript 1800	17	4.5	13.9	13.8	15.8	4.1	2.2	3.9	1.5	11.1
Okidata Okipage 10e	10	3.4	8.5	8.4	9.2	2.8	1.5	2.4	2.2	5.0
Okidata Okipage 12i	12	2.8	9.2	9.5	9.2	3.5	1.9	3.6	1.3	3.1
QMS magicolor 2 DeskLaser	16	1.6	5.4	4.3	6.3	2.2	0.8	0.9	1.2	0.9
Samsung QwikLaser 6000	12	3.8	10.7	10.7	N/A	3.0	0.9	3.4	0.9	N/A
Xerox DocuPrint P8ex	8	2.8	6.6	6.6	4.3	1.5	0.3	1.8	0.3	1.6
Xerox DocuPrint P1202	12	4.2	10.9	11.0	N/A	3.7	1.1	3.5	1.0	N/A
AVERAGE		3.2	8.8	9.2	9.4	2.1	2.4	2.9	1.9	8.1

N/A—Not applicable. The printer was unable to complete this test.

The increased complexity of this year's test targets contributed to slightly lower scores than achieved last year, but the difference was not as drastic as with the ink jet printers.

Achieving close to 16 ppm on the 42-page formatted test, the NEC SuperScript 1800, with its 17-ppm print engine, distanced the

▲ **Not surprisingly, the NEC SuperScript 1800, with its 17-ppm rated engine speed, bested the group in many categories, espe-**

cially on the Word tests. The 10-ppm Okidata Okipage 10e acquitted itself nicely among the 8- to 10-ppm lasers.

removing the network card. The printer's dual paper trays can accommodate up to 600 sheets. There is also an infrared interface that you can use for wireless printing with compliant laptops or digital cameras.—*DG and SWG*

Kyocera Ecosys FS-1200

12 ppm monochrome; 600 x 600 dpi. \$600 street. Duluth, GA; 800-232-6797; www.kyocera.com/printers.

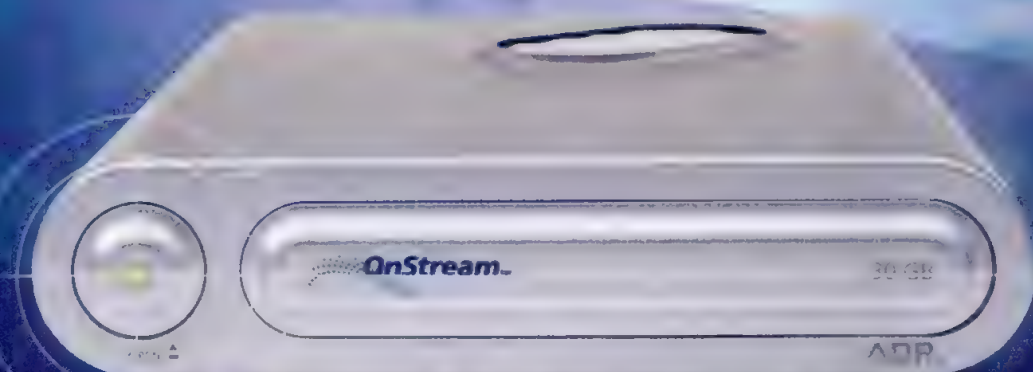
● It's hard not to like a printer whose manufacturer touts the unit as "ecologically friendly." Indeed, the Kyocera Ecosys FS-1200 uses separate print drum and toner packs; the "green" longer-life 350,000-page drum also saves money, as you replace only the toner every 40,000 pages or so. Add good quality and above-average speed and you have a commendable printer. The FS-1200 is an especially

good fit for cost-conscious small offices.

This 4MB printer comes standard with both PCL 6 and Kyocera's PostScript Level 2 clone, KPDL-2. Quality is an interesting issue. Although the printer's optical resolution is 600 by 600 dpi, Kyocera's KIR-2 (Kyocera Image Refinement 2) algorithm boosts the effective resolution to a claimed 2,400 by 600 dpi. The effect was apparent. Text and graphics

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Drive Price	\$299	\$299	\$349	\$129	\$169
Media Price	\$1.30/GB	\$3.21/GB	\$31.00/GB	\$1.34/GB	\$40.00/GB
Native Transfer Rate	1MB/s	0.75MB/s	8.7MB/s	0.66MB/s	2.4MB/s
Drive Letter Access	Yes	No	Yes	Yes	Yes
Completely Automatic Backup	Yes	Yes	No	No	No

NOTE: ALL CAPACITIES ASSUME 2:1 COMPRESSION



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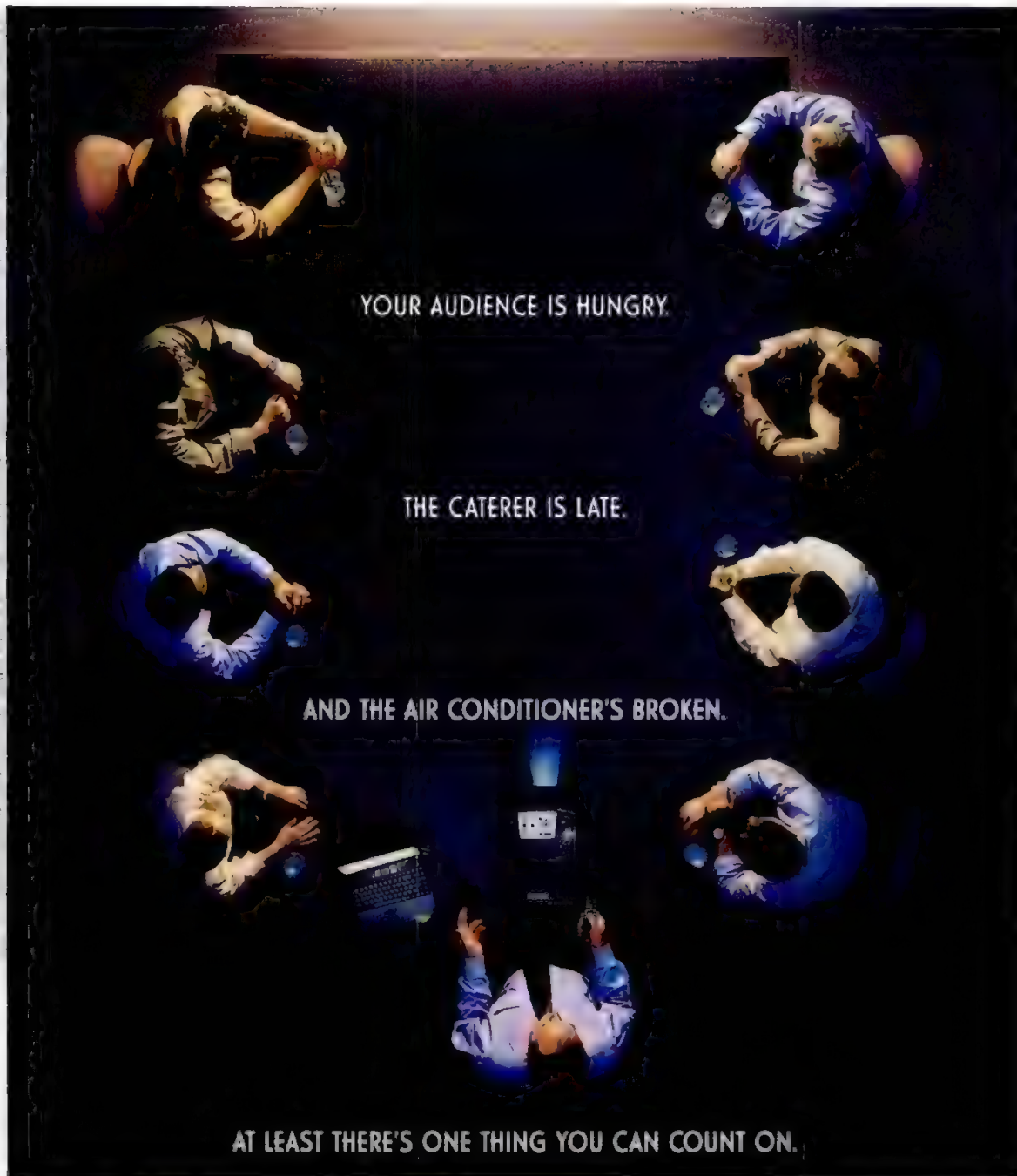


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Laser Printers

PC MAGAZINE
EDITORS' CHOICE

Continues

	Brother HL-1240	Brother HL-1250	HP LaserJet 1100xi	HP LaserJet 2100TN	Kyocera Ecosys FS-1200	Lexmark Optra E310	NEC SuperScript 870	NEC SuperScript 1800	Okidata OkidataPage 100
■ YES □ NO									
Price	\$300 street	\$400 street	\$400 street	\$1,000 street	\$800 street	\$400 street	\$350 street	\$800 street	\$300 street
Rated engine speed (ppm)	12	12	8	10	12	8	8	17	10
Resolution in draft mode/ best mode (dpi)	300 / 600	300 / 1,200 x 600	300 / 600	600 / 1,200	600 / 2,400 x 600	600 / 1,200	150 / 600	600 / 1,200	600 / 600 x 1,200
Standard RAM / Maximum RAM	2MB / 2MB	4MB / 36MB	2MB / 18MB	8MB / 40MB	4MB / 68MB	2MB / 68MB	2MB / 18MB	12MB / 132MB	4MB / 35MB
Processor speed	66 MHz	66 MHz	35 MHz	133 MHz	71 MHz	67 MHz	60 MHz	100 MHz	28 MHz
Dimensions (HWD, in inches)	9.3 x 14.2 x 14.6	9.3 x 14.2 x 14.6	14.5 x 12.8 x 14.9	15.9 x 16.5 x 12.2	12.2 x 14.7 x 15.1	8.8 x 13.6 x 14.4	10.5 x 11.5 x 15.5	11.8 x 16.8 x 17.4	7.9 x 13.0 x 14.8
Weight (pounds)	20.9	20.9	16.1	31.7	30.9	18.5	17.6	37.4	22.0
Input/output tray capacity (sheets)	250 / 150	250 / 150	125 / 100	600 + 250 / 250	350 / 250	150 / 100	150 / 100	100 + 500 / 250	250 / 100
Capacity of extra input tray (list price)	N/A	250 (\$199)	N/A	N/A	500 (\$319)	N/A	500 (\$169)	500 (\$249)	500 (\$129); power feeder, 100 (\$149)
Can use trays from previous model	□	□	□	□	■	□	□	□	■
Heaviest paper (pounds)	42	42	43	43	63	43	43	43	32
Prints on legal-size paper/envelopes	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Prints on labels/index cards	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Parallel port/Serial port/USB port	■ □ ■	■ Optional ■	■ □ □	■ □ □	■ Optional □	■ Optional ■	■ □ □	■ Optional □	■ □ □
IEEE 1284 cable included	□	□	□	□	□	□	□	□	■
Simultaneously supports multiple active ports/IrDA	■ □	■ □	□ □	■ ■	■ ■	■ □	■ □	■ ■	□ □
Internal network interface card (list price)	N/A	N/A	N/A	Included	\$295	N/A	\$249	\$299	\$249
Natively supports DOS / Windows NT	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Highest PCL version supported	PCL 4	PCL 6	PCL 6e	PCL 5e	PCL 6	PCL 6	PCL 4.5	PCL 6	PCL 5e
PostScript/PrintGear support	□ □	□ □	□ □	■ □	■ □	■ ■	■ ■	■ □	□ □
Other emulations supported	None	Epson FX-850, IBM Proprinter XL	None	None	Diablo 630, Epson LQ-850, IBM Proprinter X24E, line printer	None	None	None	Epson FX (9-pin), IBM Proprinter III XL
Watermark/booklet printing	■ ■	■ ■	■ ■	■ ■	□ □	□ □	■ ■	■ □	■ □
Thumbnail (n-up) printing/Manual duplexing	■ ■	■ ■	■ ■	■ ■	■ □	□ □	■ ■	■ ■	■ □
Standard toner capacity, in pages (list price)	3,000 (\$59.99)	3,000 (\$59.99)	2,500 (\$50.00)	5,000 (\$100.00)	5,000 (\$69.00)	5,000 (\$94.00)	3,000 (\$79.00)	8,000 (\$159.00)	2,000 (\$32.00)
Rated cost per page, 5% coverage	2 cents	2 cents	2 cents	2 cents	1.4 cents	2 cents	3 cents	2 cents	3 cents
Rated duty cycle (pages per month)	10,000	10,000	7,000	15,000	20,000	10,000	15,000	65,000	15,000
Toll-free technical support	■	■	□	□	□	■	■	■	■
Live technical support (eastern time)	9:00-8:00 M-F	9:00-8:00 M-F	8:00a-midnight M-F, noon-7:00 Sat.	8:00a-midnight M-F, noon-7:00 Sat.	8:00-7:00 M-F	9:00-9:00 M-F; noon-6:00 Sat, Sun.	8:00-8:00 M-F	8:00-8:00 M-F	24 hours, 7 days
Warranty	1 year	1 year	1 year	1 year	1 year	1 year	2 years	1 year	1 year (LED, 5 years)
Overnight exchange under warranty	■	■	■	■	□	■	□	□	■

N/A—Not applicable: The product does not have this feature. * With KPDL driver only.

were exceptionally crisp and clean for a 600-dpi-class printer. While the quality wasn't as fine as that offered by printers with an optical resolution of 1,200 dpi, it was near the top among the 600-dpi units we tested, including the HP LaserJet 2100TN and Lexmark Optra E310.

Performance was quite good across the board. The FS-1200 scored above average on most tests, dipping only on the PowerPoint test. More memory would certainly go a long way to solving this slowdown. The Kyocera Ecosys FS-1200 is a contender, though you might have some difficulty finding it. Until the end of the year it will be sold only through a major manu-

facturer (yet to be named at press time). Check Kyocera's Web site for details.
—David A. Harvey

Lexmark Optra E310

8 ppm monochrome; 600 x 600. \$400 street. Lexington, KY; 888-539-6275; www.lexmark.com.

● As low-cost monochrome laser printers go, the Lexmark Optra E310 is something else. The unit features goodies like PostScript 2 emulation, resolution enhancement, and an optional network interface that should make it attractive for small-office users and some graphics professionals. But because it ships with only 2MB of memory (upgradable to 64MB), it

cannot print full-page or complex graphics files at its best settings.

Text output was sharp and thin but quite readable. The E310 normally prints at 600 by 600 dpi, but with image enhancement its effective resolution is 1,200 by 1,200 dpi. The E310, however, was incapable of printing our 8MB gray-scale test image (an informal trial run by our reviewers) in either resolution. We got around this barrier by changing from PostScript to PCL 6 emulation and printing at only 600 dpi. Even so, the printed image was marred by faint, tiny vertical lines every few millimeters. Lexmark says that the basic E310 is not really suited for printing



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SUMMARY OF FEATURES

Laser Printers

Ends

	Okidata OkiPage 12i	QMS magicolor 2 DeskLaser	Samsung QwikSoft Laser 6000	Xerox DocuPrint P6ex	Xerox DocuPrint P1202
■ YES □ NO					
Price	\$800 street	\$999 list	\$950 street	\$400 street	\$700 street
Rated engine speed (ppm)	12	Mono, 12; Color, 4	12	8	12
Resolution in draft mode/ best mode (dpi)	600 / 600 x 1,200	600 / 600	N/A / 600	N/A / 600	N/A / 600
Standard RAM / Maximum RAM	4MB / 36MB	32MB / 64MB	4MB / 36MB	4MB / 36MB	4MB / 36MB
Processor speed	40 MHz	16 MHz	100 MHz	33 MHz	100 MHz
Dimensions (HWD, in inches)	7.9 x 13.0 x 14.8	19.7 x 19.3 x 15.3	8.7 x 14.2 x 14.5	16.3 x 14.3 x 13.5	8.7 x 14.2 x 16.8
Weight (pounds)	22.0	90.0	24.2	16.5	24.3
Input/output tray capacity (sheets)	250 / 150	250 / 250	250 / 250	150 / 100	350 / 110
Capacity of extra input tray (list price)	500 (\$289)	250 (\$129)	250 (\$199)	N/A	250 (\$150)
Can use trays from previous model	■	N/A	N/A	N/A	□
Heaviest paper (pounds)	32	30	Info not avail- able	43	43
Prints on legal-size paper/envelopes	■ ■	■ ■	■ ■	■ ■	■ ■
Prints on labels/index cards	■ ■	■ ■	■ ■	■ ■	■ ■
Parallel port/Serial port/USB port	■ ■ □	■ ■ □	■ ■ □	■ ■ □	■ ■ □
IEEE 1284 cable included	■	■	■	■	■
Simultaneously supports multiple active ports/irDA	□ □	■ □	□ □	■ □	■ □
Internal network interface card (list price)	\$249	Included	N/A	N/A	N/A
Natively supports DOS / Windows NT	■ ■	■ ■	■ ■	■ ■	■ ■
Highest PCL version supported	PCL 6	None	PCL 6	PCL 6	PCL 6
PostScript/PrintGear support	■ □	□ □	■ □	□ □	■ □
Other emulations supported	Epson FX (9-pin), IBM Proprinter III XL	Windows GDI	None	None	None
Watermark/booklet printing	■ □	□ □	□ □	■ ■	■ ■
Thumbnail (n-up) printing/Manual duplexing	■ □	□ ■	□ □	■ ■	■ ■
Standard toner capacity, in pages (list price)	2,000 (\$32.00)	10,000 (\$99.00)	5,000 (\$109.00)	5,000 (\$180.00)	6,000 (\$179.00)
Rated cost per page, 5% coverage	3 cents	2 cents	2 cents	3 cents	2 cents
Rated duty cycle (pages per month)	15,000	20,000	15,000	8,000	12,000
Toll-free technical support	■	■	■	■	■
Live technical support (eastern time)	24 hours, 7 days	8:00-8:00 M-F	8:00-7:00 M-F	8:00-8:00 M-F, 11:00-3:00 Sat.	8:00-8:00 M-F, 11:00-3:00 Sat.
Warranty	1 year (LED, 5 years)	1 year	1 year	1 year	1 year
Overnight exchange under warranty	■	□	□	■	■

N/A—Not applicable. The product does not have this feature.

graphics until the user adds more memory.

In our speed testing, the E310 held its own against the other 8-ppm printers in the group. In fact, these printers outpaced many units with 10- and 12-ppm rated engine speeds in several instances.

We experienced no problem in setup and installation, and replacing the long-life toner cartridge is, literally, a snap. The E310 output a first print in 17 seconds when printing text, but it could take longer when printing graphics files. The E310 comes with both parallel and USB interfaces, and the unit can connect to either a Mac or a PC, but not at the same time.—DG and SWG

NEC SuperScript 870, 1800

870: 8 ppm monochrome; 600 x 600. \$350 street. 1800: 17 ppm mono; 1,200 x 1,200. \$800. Itasca, IL; 800-632-4636; www.nectech.com.



With a street price of \$350, the 8-ppm NEC SuperScript 870 is clearly a personal printer, while the NEC SuperScript 1800's \$800 price tag puts it in the small-office and home-office category. But the 1800's 17-ppm print speed is fast enough for a moderately large workgroup, and the built-in internal duplexer, 12MB RAM, and 8,000-page-per-month

rated duty cycle make it even more appropriate as a shared printer.

Setup for the two printers is similar in general description at least, consisting of little more than installing the toner cartridge, plugging the printer in, and installing the driver and NEC status monitor. The drivers are different but offer similar features, including watermarks



The combination of features on the 1800 (right) makes it an Editors' Choice.

and n-up printing. Both printers also come with status-monitoring software, which is an important extra if you share a printer over your network.

The text output quality of the 870, which uses Adobe PrintGear as its language, was appropriate for a 600-dpi laser printer. Graphics and gray-scale photos showed little dithering, although the photos lost subtle shading in dark areas. The performance was likewise appropriate for the claimed engine speed.

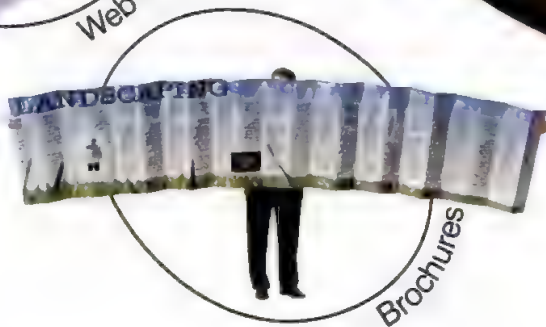
The 1800, which uses PCL 6 and includes a resolution enhancement feature that NEC claims is equivalent to 1,200 dpi, offers both better quality and better performance than the 870. The quality difference occurred primarily in photos, where it was apparent in less obvious dithering patterns. Even better, the printer's speed will rarely leave you waiting. All told, this combination of output quality and performance—plus the internal duplexer—makes the 1800 hard to beat.—MDS

Okidata OkiPage 10e, 12i

10e: 10 ppm monochrome; 300 x 1,200. \$330 direct. 12i: 12 ppm mono; 600 x 1,200. \$660. Mount Laurel, NJ; 800-654-3282; www.okidata.com.

● These two little lasers look quite similar, but they are positioned for different markets. The Okidata OkiPage 10e is aimed at small to medium-size businesses. The Okidata OkiPage 12i is intended for power users and small workgroups. Both

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do a fine job with text, but they are average performers for their speed ratings and are a bit weak on photographic images. Neither has a compelling combination of price, features, and performance compared with the competition—notably the Brother and NEC lasers.

The OkiPage 10e supports PCL 5e, as well as old Epson and IBM ProPrinter dot matrix compatibility modes. Paper handling is reliable. Print quality was solid and black for text, but streaking was readily apparent on photographic images. The unit was average on our speed tests. The low price is appealing, but there are better bargains available, namely the Brother HL-1240 and the NEC SuperScript 870.

It's not quite correct to call these laser printers; the print engine relies on an array of LEDs to expose the light-sensitive imaging drum. Both printers have drivers with few advanced features aside from watermarks, and both have a single 250-sheet internal paper tray.

The OkiPage 12i is positioned for more demanding applications, yet it has the same standard paper capacity and the same 15,000-page-per-month duty cycle as the 10e. The major differences are additional speed and support for PCL 6 and PostScript 2. On our speed tests, the printer failed to distinguish itself, falling below average in its ppm category. The printer delivered high-quality text pages, but there was some streaking on photographic images, and occasionally the paper would misfeed and come out of the printer wrinkled.—AP

QMS magicolor 2 DeskLaser

16 ppm monochrome/4 ppm color; 600 x 600. \$999 list. Mobile, AL; 800-523-2696; www.qms.com.

● The personal color laser printer has officially arrived, in the form of the QMS magicolor 2 DeskLaser. Targeting power users and the small-office market, it may well be the most cost-effective choice for those who need both color and the speed available only from lasers.

Setting up the magicolor 2 is reasonably typical for a color laser. You need to install four toner cartridges, an OPC belt cartridge, an oil bottle, and a cleaning

roller, and then you can install the driver. An unusual touch for a color laser printer driver is an automatic mode that saves you from having to choose the best settings for each document you print. More important, the feature worked well on our tests.

Text and graphics output was appropriate for a 600-dpi laser, with sharp edges, well-formed text characters, and bright saturated colors for graphics. Photo output on glossy paper was just short of photo-realistic. Dithering was clearly apparent in gray-



The magicolor 2 offers a winning combination of speed and color printing.

scale photos, along with some minor streaking. We saw no streaking and less obvious dithering in color photos. And the speed was appropriate for the printer engine. All told, the magicolor 2 is a highly attractive package for the price. Note that \$999 is a promotional price running through the end of the year, after which the cost will be \$1,299 list.—MDS

Samsung QwikLaser 6000

12 ppm monochrome; 600 x 600 dpi. \$650 street. Additional paper tray, \$190. Ridgefield Park, NJ; 800-726-7864; www.samsung.com.

● Priced toward the high end of its class, the Samsung QwikLaser 6000 promises a lot. With a rated 12-ppm speed, this extremely compact printer should serve a busy home office, a small business, or a bustling workgroup. Unfortunately, the reality behind the 6000's specs tells a different story.

Ascertaining quality was vexing. For some reason, we had problems printing another informal test that we ran—a full-page graphics file: On some occasions the page would print; on others we'd get an "out of memory" error. There didn't seem to be a discernable pattern to the errors.

When it printed, however, the QwikLaser produced quality images and text that were consistent with the best of the 600-dpi printers we saw.

Print speed was not particularly good. Again, we encountered memory errors in printing test documents. The speed was relatively poor on short documents and just above average on longer jobs.

Samsung needs to go back into the engineering lab with this one. No 4MB printer should have trouble with our test files, nor should a 12-ppm-rated engine print so slowly.—DAH

Xerox DocuPrint P8ex, P1202

P8ex: 8 ppm monochrome; 600 x 600. \$400 street. P1202: 12 ppm mono; 600 x 600. \$700. Webster, NY; 800-349-3769; www.xerox.com.

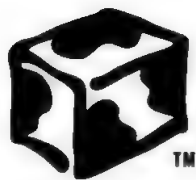
● Xerox identifies both the Xerox DocuPrint P8ex and P1202 as personal laser printers, but the 8-ppm P8ex is more clearly a personal printer. The 12-ppm P1202 is appropriate for a power user or as a shared printer in a small office. Although both are reasonable choices, both suffer from a quality enhancement feature that actually degraded the quality on our tests.

The PCL 6 drivers are nearly identical for the two printers, both printing watermarks and offering *n*-up features for up to nine pages per sheet. The P1202 adds booklet printing and semiautomatic duplexing.

The P8ex's text output was suitably crisp. Graphics and photos showed little dithering and retained subtle shading. But on our tests the driver's photo enhancement setting made output quality noticeably worse. Xerox says that whether this feature will help or hurt depends on the particular image. That means you have to find out by trial and error, and we conclude that the feature is generally best ignored. The tested speed was slow for an 8-ppm printer.

The P1202 also offers crisp text and high-quality graphics output. On our tests, however, photo output was marred with some subtle streaks. The printer also suffered from the same problem as the P8ex, with the photo enhancement setting degrading quality. All told, the P1202 is outdone by other printers, notably the NEC SuperScript 1800, which offers lots more printer for only a little more money.—MDS

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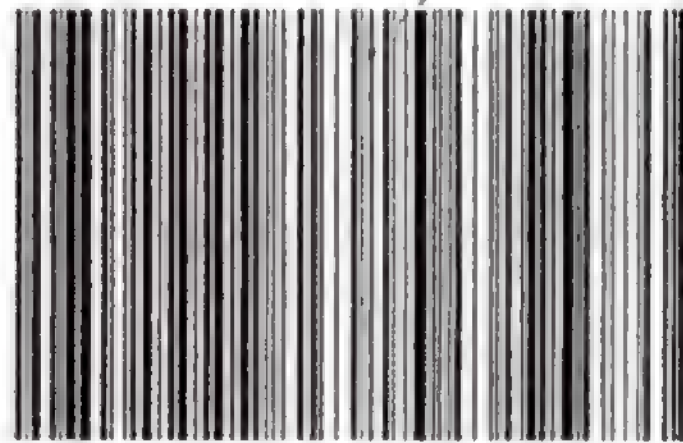
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1. Follow instructions on the other side

Back

GBSS-Back-001B



Inverted Back

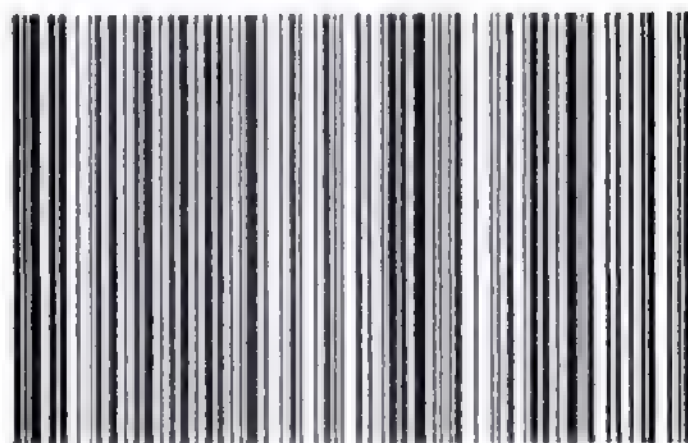
1. Follow instructions on the other side



1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet

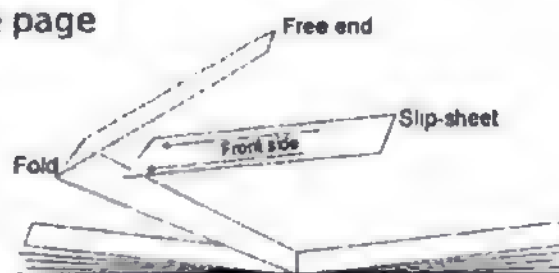
Foldout slip-sheet

Folded edge of the page



Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



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multifunction printers

Brother MFC-7150c, MFC-8300, MFC-8600

MFC-7150c: 6 ppm monochrome/4 ppm color; 1,440 x 720. \$400 street. **MFC-8300:** 12 ppm mono; 600 x 600. \$500. **MFC-8600:** 12 ppm mono; 600 x 600. \$800. Bridgewater, NJ; 888-879-3232; www.brother.com.

● While each of the three Multifunction Center (MFC) Brothers we reviewed bears an unmistakable familial resemblance, the laser-based Brother MFC-8300 and MFC-8600 and the color ink-jet-based MFC-7150c all have distinct personalities. All three are aimed at both the home and SOHO markets, but the capabilities of the MFC-7150c and MFC-8600 also render them suitable for the small-business market. Both the MFC-8600 and MFC-7150c impressed us with their combination of functionality, print quality, and speed. The MFC-8300, however, suffers from a lack of RAM.

As a group, the Brothers did exceptionally well on our concurrency test, an informal trial that measured each unit's ability to handle multiple types of jobs simultaneously. All three units let us copy, scan, and send and receive faxes while they were toiling away at a large print job.

Both USB-equipped lasers, the top-of-the-line Brother MFC-8600 and the lesser MFC-8300, are built around a 12-ppm 600- by 600-dpi laser print engine and come in a well-designed case that sports a telephone handset, a dial pad, a two-line LCD, and function keys that double as quick-dial buttons. And each unit holds 250 sheets of paper. Sharing a similar look and the same basic functionality as the lasers, the MFC-7150c is built around a color ink jet engine and provides the same feature set as the MFC-8600, but it holds only 200 sheets of paper. Each of these units uses a 14.4-Kbps fax mechanism.

The MFC-8300 serves as a fax machine, printer, and monochrome copier. Unfortunately, it fared poorly on our quality tests. Equipped with a paltry 2MB of RAM, the MFC-8300 couldn't print

some of the more resource-intensive images, like the gray-scale image that we used for our informal trial. Despite using the same engine as the MFC-8600, the MFC-8300 turned in slower performance, resulting in large part from the lower amount of RAM.

Still, the MFC-8300 performed well above average compared with the other laser-based multifunction printers. The biggest problem with the MFC-8300 is that its lack of memory renders this printer unsuitable for complex, full-page graphics jobs. Should you choose this printer, you'll almost certainly have to upgrade the RAM.

For \$100 more, you can turn to the MFC-8600. This 4MB laser-based multifunction unit does duty as a 600- by 300-dpi color scanner (with interpolation up to 1,200-by-1,200), a monochrome copier, a standalone fax machine, a PC fax, a video capture device, and a printer that connects via either a USB or a parallel port.

Included with the MFC-8600 is a very good software bundle consisting of ScanSoft's PaperPort (formerly Visioneer PaperPort), ScanSoft's TextBridge (for OCR), Multifunction Link Pro (fax software), NetCentric's FaxStorm (for Internet faxing), and Brother's automatic e-mail print utility, not to mention a video-frame capture utility.

The MFC-8600 delivered good to above-average output. As for speed, the MFC-8600 yielded very good results, consistently turning in scores that were well above average and in some cases ranked with the top laser performers.

The MFC-7150c stands alone. It had the fastest ink jet engine we tested, and it comes replete with the same dizzying array of features as the MFC-8600, adding color fax, copying, and printing to standard fax, PC fax, color scanning, and video capture capabilities. Besides including all of the same software shipped with the MFC-8600, and the same scanner unit, the MFC-7150c also comes with

3D FaxSpeed for color faxing.

With a print speed that brings to mind the sprinter Ben Johnson, the MFC-7150c was the fastest or near-fastest in every category on our tests, outdistancing the nearest ink jet by a good margin.

Quality, unfortunately, was another matter. Though the MFC-7150c did well when printing business graphics and quick color copies, its photo output at the high-quality level did not impress us. The unit's speed and multiplicity of features, however, are enough to recommend it to many buyers.—DAH

Canon MultiPass C530

5 ppm monochrome/2 ppm color; 720 x 360. \$350 street. Costa Mesa, CA; 800-652-2666; www.ccsi.canon.com

● All set for the SOHO market, with an appealing combination of features and price, the Canon MultiPass C530 is a very good value. Even if you use it only as a standalone color copier and plain-paper fax machine, it's a fine deal; but when you add its printing and scanning abilities, plus the impressive set of bun-



At \$350, the Canon MultiPass C530 offers a good combination of features and value.

dled software, it's clearly a valuable and flexible tool.

Setting up the C530 was uneventful. The printer uses the same ink cartridges and tanks found in several other Canon Bubble Jet printers. The standard cartridge holds a black tank and a three-color tank; a photo color tank and high-capacity black and color tanks are optional. The automatic sheet feeder holds 30 pages, and the paper input tray holds 100 sheets. Canon's Creative Pro software bundle includes Adobe PhotoDeluxe Business

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HARDWARE Printers

MULTIFUNCTION PRINTERS

INK JET	Street price	Print quality	Scan quality	Fax functions	Overall speed	Service and Reliability grade*
Brother MFC-7150c	\$400	Good	Excellent	Excellent	Fair	D
Canon MultiPass C530	\$350	Fair	Good	Good	Good	D
Compaq A900 All-in-One	\$350	Good	Excellent	Good	Fair	A
Epson Stylus Scan 2000	\$350	Excellent	Excellent	N/A ¹	Fair	A
Editors' choice HP OfficeJet R90	\$800	Excellent	Excellent	Excellent	Good	A
HP OfficeJet T65	\$800	Excellent	Good	Excellent	Good	A
Xerox WorkCentre 480CX	\$600	Good	Excellent	Good	Fair	B
LASER						
Brother MFC-8300	\$500	N/A ²	N/A ¹	Good	Fair	D
Brother MFC-8600	\$600	Good	Excellent	Excellent	Good	D
HP LaserJet 3100xi	\$700	Good	Good	Excellent	Fair	A
Xerox WorkCentre 385	\$500	Fair	N/A ¹	Good	Good	B

* A: Above average; Jan. '99; N/A¹: Not applicable. The product does not have this feature.
N/A²: Not applicable. The Brother MFC-8300 did not have enough memory to complete our tests.

Edition, ScanSoft's TextBridge Pro (for OCR), ChromaFax, OfficeReady, and Desktop Manager 3.1 for faxing.

The printer is easy to use, even without resorting to the manual. A fold-down front cover reveals dialing buttons and a number of well-marked function keys. One important feature is that incoming faxes are automatically stored whenever

you're using the C530 for other functions, including printing, scanning, copying, and even sending faxes.

Print quality for text and graphics output was very good, certainly suitable for general small-office or home use, although we saw minor banding when printing photographic images, both on plain paper and on Canon's glossy photo

stock. On our speed tests, the Canon posted average scores.—BB

Compaq A900 All-in-One

8 ppm monochrome/4 ppm color; 1,200 x 1,200 dpi. \$350 street. Houston; 800-888-0220; www.compaq.com.

●The Compaq A900 All-in-One is one of the most robust multifunction units we saw. Although it doesn't lead with speed or quality, this ink jet printer is the most convenient unit to operate, and it offers a strong set of features and software—a good choice for a busy small office or home with heavy document demands.

On our speed tests, the A900 acquitted itself with mostly average performance. The bright spots were quick timings on long documents and on our Excel tests. The quality was above average: Text was clean and crisp down to 4-point size, and graphics were rich and well detailed.

The A900's scan/copy features were solid. While the 300- by 300-dpi, 24-bit scan engine doesn't stack up to higher-resolution units from Canon and HP, the software interpolation permits a maximum resolution of 4,800 by 4,800 dpi and

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did produce good quality. This isn't the scanner for those with high-quality photography to archive; for standard color and monochrome business copies and scans, however, it does just fine.

What really makes the A900 stand out is the number of methods by which you can control the unit. The front panel includes a much-appreciated scan button that lets you send documents directly into your PC. The A900 Utility lets you configure virtually every setting from your PC, including quick-dial keys, copy and fax settings, and more. In addition, the Compaq Control Form—a printed request form that you fill out by hand and feed into the scanner—allows you to initiate scan, copy, or fax jobs and change settings.—*DAH*

Epson Stylus Scan 2000

8 ppm monochrome/5 ppm color; 1,440 x 720. \$350 street. Torrance, CA; 800-463-7766; www.epson.com.

● Taking a road less traveled, Epson's multifunction offering, the Epson Stylus Scan 2000, drops the fax capability to deliver a color scanner/copier/printer that

churns out beautiful-quality originals and reproductions on a wide range of stock. This printer is well suited for those who need quality output and copy/scan functionality in a single box—especially for photographers. It would also be well used at home or in a small office.

We reviewed the Stylus Scan 2000 and also got a peek at a preproduction version the Stylus Scan 2500 Pro. Both Stylus Scan printers come with USB and parallel ports and are built around Epson's MicroPiezo ink jet technology, which delivers a maximum resolution of 1,440 by 720 dpi.

The Stylus Scan 2000 is a well-designed, compact unit. The combination of the Epson driver and status application provides you with a wealth of information and diagnostic tools for your printer. Epson's Smart Panel is a convenient collection of icons that let you quickly perform basic scanning and printing tasks.

Text and graphics quality were almost flawless. Even under an 8X loupe, text still looked crisp and well formed, without evidence of the familiar ink jet bleeding. The Epson didn't make waves on

our speed tests, however, and on the whole the printer turned in a below-average performance. The text speed is rated at 3 ppm for monochrome and 1.4 ppm for color originals.

Epson's scan unit is a 36-bit 300- by 600-dpi CCD (charge-coupled device) scan unit that allows a maximum interpolated resolution of 4,800 by 4,800 dpi. The scanner, which can process flat sheets from 2 by 3.5 inches to 8.5 by 14 inches, produced clean, crisp scans and copies.

The Epson driver makes creating stunning output a snap. Although you can rely on the default settings, a status pane details the resolution and color mode. Pop into the advanced pane and you can precisely tune resolution and color.

The software bundle includes Adobe PhotoDeluxe, WinFax Basic (which requires a fax/modem), and Presto! (OCR software).

The \$700 Stylus Scan 2500 Pro's claim to fame is a flatbed that sports an ADF (automatic document feeder) and is based on a 2,400- by 600-dpi scan engine that delivers 36-bit color resolution and a max-

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PERFORMANCE TESTS

Multifunction Printers



Among the laser multifunction printers (MFPs), the Brother MFC-8300 and MFC-8600 stood out. In the ink jet MFP category, the Brother MFC-7150c bested not only the other ink jet MFPs but also the fastest of the standard ink jet printers.

The MFPs in this roundup are designed to perform various additional tasks such as copying, faxing, and scanning. Though we evaluated these functions qualitatively and discuss them in the reviews, we measure and report here only the results of our rigorous printing performance tests.

When it comes to printing speed, the Brother MFPs dominated their respective fields. The Brother MFC-8300 and MFC-8600 rivaled the elite laser printers. They nearly doubled the slowest laser MFP's speed on the graphics-intensive 12-page formatted text test. When printing a short document, however, the two Brother laser MFPs paled in comparison with the Xerox Work-

Centre 385. Xerox's MFP showed a much shorter latency in starting the printer engine to produce a 1-page letter or a 1-page table.

In the ink jet category, the Brother MFC-7150c had no equal. It outran even the fastest standard ink jet printer in this roundup, the HP DeskJet 895Cse, by an average of almost 11 percent. The MFC-7150c was exceptionally quick when printing graphics, as shown on the 3 pages, text and graphs test. Falling slightly off pace from the leading ink jet printers were the Compaq A900 All-in-One and Xerox WorkCentre 480CX. The Compaq and Xerox units performed well when called on to produce 1-page documents. The HP OfficeJet T65 was not too far behind the leading ink jet MFPs in producing the last page of each print job, but like other HP ink jets it had a lengthy return-to-application time when printing graphics-intensive jobs such as PowerPoint slides. The OfficeJet T65 tied up the host PC for more than 10 minutes before returning control to the user.

How We Tested

For each multifunction printer we measured performance using the same tests used for its standard ink jet or laser counterpart.

We set the printer drivers to 600 dpi, or as close to it as possible, in text and graphics mode. We measured the *click-to-clunk time*, which we define as the duration from the moment you click

the OK button in the print dialog box to the moment the last page is released to the output tray. Consequently, these tests represent the performance that users will actually experience. In the chart, we present the data in *effective pages per minute*—a calculation based on the click-to-clunk time, which includes the first-page-out delay beginning each print job.

—Analysis written by S. Jae Yang. Special thanks to Pete Duff and Ken Kim of QualityLogic.

Effective ppm High scores are best!	Microsoft Word 97			Microsoft Excel 97			Netscape Navigator 4	Microsoft PowerPoint 97
	1-page letter	12 pages, unformatted text	12 pages, formatted text	1-page table	3 pages, text and graphs	1-page graph	2 Web pages	12 pages, slides
INK JET								
Brother MFC-7150c	2.8	2.6	2.9	2.9	1.5	2.0	0.7	0.9
Canon MultiPass C530	1.4	1.5	1.9	1.2	0.3	0.4	0.6	0.3
Compaq A900 All-in-One	1.8	1.9	2.0	2.8	0.4	0.4	0.4	0.2
Epson Stylus Scan 2000	0.6	0.7	0.7	0.9	0.4	0.4	0.5	0.4
PC HP OfficeJet R80	1.5	2.6	1.6	1.4	0.3	0.3	0.4	0.9
HP OfficeJet T65	1.5	2.6	1.6	1.4	0.3	0.3	0.4	0.2
Xerox WorkCentre 480CX	1.9	2.1	2.0	2.7	0.4	0.4	0.4	0.3
LASER								
Brother MFC-8300	2.2	8.8	9.3	2.5	4.2	2.5	2.3	9.0
Brother MFC-8600	1.9	8.9	9.2	2.4	4.2	2.5	2.3	9.4
HP LaserJet 3100xi	2.8	5.3	4.7	2.6	2.2	2.2	1.8	4.8
Xerox WorkCentre 305	3.1	5.8	6.8	2.9	4.1	3.0	3.4	6.4

imum interpolated resolution of 9,600 by 9,600 dpi. The 2500 series can handle 8.5-by-11.7-inch originals.

In short, we were very impressed by the Stylus Scan 2000 and by the potential of the Stylus Scan 2500 Pro. While we question the decision to drop fax capability, we do see the market for a color printer/copier.—DAH

HP OfficeJet T65, R80, LaserJet 3100xi

T65: 11 ppm monochrome/8.5 ppm color; 600 x 600 \$600 street. **R80:** 11 ppm mono/8.5 ppm color; 600 x 600 \$800. **3100xi:** 6 ppm mono, 600 x 600. \$700. Palo Alto, CA, 800-752-0900, www.hp.com.



Hewlett-Packard doesn't hesitate to add models to cover all niches in fertile markets, as evidenced by the new T-series and R-series OfficeJet lines and the HP LaserJet 3100xi. The HP OfficeJet T65 and R80, both intended for the SOHO market, use the same ink jet-based print engine, with HP's PhotoREt II color-layering technology for printing photographs. The LaserJet 3100xi is simple to set up and operate; it has a small footprint but big versatility. What's missing is color capability and the ability to print graphics at 600 dpi.

The T65 is a sheet-fed model for faxing, copying, and scanning, with color fax capability. The R80, which handles monochrome faxing only, can scan, fax, and copy via a flatbed or a 30-page sheet feeder.

The T65 has a 20-page automatic document feeder (ADF), 10 one-touch fax buttons, 100 speed dials, and a 75-page fax memory. The scanner, with 300- by 600-dpi optical resolution (or 1,200 dpi with interpolation), is useful for color and black-and-white copying, as well as fax transmission and PC scanning. Quick, easy-to-find one-touch buttons let you fax, copy, and scan from the front panel.

The T65 is relatively compact (8.9 by

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SUMMARY OF FEATURES

Multifunction Printers

PC MAGAZINE
 EDITOR'S CHOICE

Ink Jet Laser

☒ YES ☐ NO

	Brother MFC-7150c	Canon MultiPass C530	Compaq A900 All-in-One	Epson Stylus Scan 2000	HP OfficeJet R80	HP OfficeJet T65	Xerox WorkCentre 480CX	Brother MFC-8300
Street price	\$400	\$350	\$350	\$350	\$800	\$800	\$500	\$500
Cost of replacement toner or ink	Black, \$17, color, \$9	Black, \$37, color, \$53, photo, \$47	Black, \$33, color, \$40	Black, \$29.95, color, \$29.95	Black, \$29, color, \$33	Black, \$29, color, \$33	Black, \$40; color, \$37, photo, \$40	Black, \$60
Cost per page (monochrome, 5% coverage)	2 cents	5 cents	Info not available	4.5 cents	3.5 cents	3.5 cents	3.7 cents	2 cents
Dimensions (HWD, in inches)	9.7 x 21.3 x 15.4	8.1 x 14.4 x 12.7	9.1 x 17.1 x 14.0	11.0 x 17.0 x 18.5	18.4 x 17.3 x 19.8	8.9 x 19.1 x 14.1	11.5 x 22.1 x 17.8	12.7 x 17.1 x 17.4

PRINTING

Rated engine speeds (monochrome/color, in ppm)	8 / 4	5 / 2	8 / 4	6 / 5	11 / 8.5	11 / 8.5	8 / 4	12 / N/A ¹
Maximum monochrome resolution (dpi)	1,440 x 720	720 x 360	1,200 x 1,200	1,440 x 720	600 x 600	600 x 600	1,200 x 1,200	600 x 600
Maximum color resolution (dpi)	1,440 x 720	720 x 360	1,200 x 1,200	1,440 x 720	600 x 600	600 x 600	1,200 x 1,200	N/A ¹
Individually replaceable color cartridges	☒	☒	☒	☒	☐	☐	☐	N/A ¹
"Low ink" or "low toner" warning	☒	☐	☒	☒	☒ (black only)	☒ (black only)	☐	☒
Stops printing if one color runs out	☐	☐	☐	☒	☐	☐	☐	N/A ¹
Rated monthly duty cycle (pages)	1,500	Info not available	500	Info not available	3,000	3,000	1,050	10,000
Prints from a DOS box or Windows	☒	☒	☒	☐	☐	☐	☒	☒
Highest printer emulation supported	Brother Windows Printing System, Epson ESC/P	Canon Extended Mode	PCL 3	ESC/P Raster	PCL 3 (limited capability)	PCL 3 (limited capability)	GDI	Brother iMac Printing System, Brother Windows Printing System, PCL 4
Input/output tray capacity (sheets)	200 / 75	100 / 100	100 / 200	100 / 30	100 / 50	100 / 50	100 / 50	250 / 150
Transparency/envelope tray capacity	20 / 10	50 / 15	15 / N/A ²	N/A ² / 10	25 / 15	25 / 15	N/A ² / N/A ²	10 / 1

FAXING

Modem speed (Kbps)	14.4	14.4	14.4	N/A ²	14.4	14.4	14.4	14.4
Paper feed capacity/Memory capacity (pages)	20 / 100	100 / 42	30 / 30	N/A ² / N/A ²	30 / 100	20 / 75	30 / 200	30 / 90
Telephone handset	☒	☐	☐	N/A ²	☐	☐	☐	☒
Telephone jacks/Speed-dial presets	☒	☒	☒	N/A ² / N/A ²	☒	☒	☒	☒
Fax software supplied	Multifunction Link Pro, NetCentric Fax Storm, 3D FaxSpeed	Chromafax	WinFax Basic Edition 9.0	eFax.com, WinFax Basic	HP OfficeJet Manager	HP OfficeJet Manager	Laser FAX Lite	Multifunction Link Pro

SCANNING

Monochrome or color scanning (bit depth)	Color (24-bit)	Color (24-bit)	Monochrome (8-bit), color (24-bit)	Monochrome (12-bit), color (36-bit)	Monochrome (8-bit), color (24-bit)	Monochrome (8-bit), color (24-bit)	Monochrome (8-bit), color (24-bit)	N/A ²
Highest optical scanning resolution (dpi)	300 (1,200 interpolated)	600	300	300 x 600	9,600	1,200	300	N/A ²
OCR software included	TextBridge	TextBridge Pro	TextBridge	NewSoft Presto	I.R.I.S.	I.R.I.S.	TextBridge	None
Document management software included	ScanSoft PaperPort	Canon Executive Pro	Pagis ScanWorks	Epson Smart Panel	None	None	Pagis Pro	None

COPYING

Rated engine speed (monochrome, in ppm)	3	3	4	3	11	8	5	12
Maximum number of copies	99	99	99	99	99	99	99	99
Resolution (dpi)	720 x 720	300 x 360	1,200 x 1,200	360 x 360	600 x 2,400	300 x 300	300 x 300	600 x 800
Reducing/enlarging (percent of original)	50 / 200	100 / 100	25 / 200	70 / 141	25 / 400	25 / 400	25 / 200	50 / 200
Overnight exchange under warranty	☒	☐	☒	☐	☒	☒	☒	☒

 N/A¹—Not applicable. This is a monochrome printer. N/A²—Not applicable. The product does not have this feature.

19.1 by 14.1 inches) and is bundled with G&A Imaging's PhotoRecall Deluxe. It was a better-than-average performer on the key test that involved printing a 12-page unformatted document, although its scores on other tests ranged closer to average levels. Output quality on all tests was excellent, from text to photographic images—which, when printed on HP's Premium Photo Paper, were easily good enough for presentations.

As good as the T65 is, the HP OfficeJet R80 is even better, although it costs \$200 more and takes up more desk space, measuring 18.4 by 17.3 by 19.8 inches. The R80 has a flatbed for scanning, fax, and copy input and greater scanning resolution, but it does not support color faxing. The optical scanning resolution is 600 by 2,400 dpi, or 9,600 dpi with interpolation. In addition to its 30-page ADF, the R80 has 12 one-touch keys, 100 speed dials,

and a 100-page memory for received faxes. Bundled software includes Adobe PhotoDeluxe Business Edition and KMT Office in Color templates for use with Microsoft Office 95, 97, and 2000.

As with the HP OfficeJet T65, the output quality is simply outstanding in all modes. If you have the extra space for the HP OfficeJet R80 and don't need color faxing, this is the all-in-one printer of the year.

The HP LaserJet 3100xi is actually a

Brother MFC-8600	HP LaserJet 3100xi	Xerox WorkCentre 385
\$600	\$700	\$500
Black, \$60	Black, \$85	Black, \$124
2 cents	2 cents	2.5 cents
12.7 x 17.1 x 17.4	10.8 x 18.5 x 15.1	9.4 x 14.0 x 16.3
12 / N/A ¹	6 / N/A ¹	8 / N/A ¹
600 x 600	600 x 600	600 x 600
N/A ¹	N/A ¹	N/A ¹
N/A ¹	N/A ¹	N/A ¹
■	□	■
N/A ¹	N/A ¹	N/A ¹
10,000	6,000	8,000
■	■	□
Brother iMac Printing System, Brother Windows Printing System, PCL 4	PCL 4	Windows Printing
250 / 150	100 / 100	150 / 100
10 / 1	110 / 10	N/A ² / N/A ²
14.4	14.4	14.4
30 / 270	30, 150	30 / 150
■	■	□
■	■	■
Multifunction Link Pro, Netcentric Fax Storm	JetSuite Pro	Laser FAX Lite
Monochrome (8-bit)	Monochrome (8-bit)	Monochrome (8-bit)
300 x 600 (1,200 interpolated)	300	300
TextBridge	I.R.I.S.	TextBridge
ScanSoft PaperPort	Jet Suite Pro	None
12	6	8
99	99	99
600 x 600	600 x 600	300 x 300
50 / 200	50 / 200	50 / 200
■	■	■

300-dpi optical printer, with firmware interpolation that boosts it to 600 dpi. At that resolution, text is crisp, clean, and dark. But printing graphics automatically downshifts output to 300 dpi, and though users can select three halftone modes, the images are somewhat underexposed, with little detail. Our top speed was very close to the unit's official rating, at just under 6 ppm.

The 3100xi's most significant feature is its practical concurrency; unlike some



The HP R80 and T65 use PhotoRet II color-layering technology for great prints.

other multifunction units, the printer can operate several functions at once. We faxed, copied, printed, and scanned simultaneously without any difficulty. What we didn't like was the 3100xi's flimsy wire frames for supporting paper; we would prefer more substantial plastic paper guides.—BB, DG, and SWG

Xerox WorkCentre 385, 480CX

385: 8 ppm monochrome; 600 x 600. \$500 street. **480CX:** 8 ppm mono/6 ppm color; 1,200 x 1,200. \$500. Rochester, NY; 800-832-6979; www.teamxrx.com.

Each of Xerox's duo of WorkCentres delivers fax, PC fax, copier, scanner, and print functionality in a well-designed case. The Xerox WorkCentre 385 does so with laser, the 480CX with color ink jet. Both are suitable for either SOHO or home use. The pair rated just average on our tests, and neither would be suitable for high-quality graphics work.

Setup for both printers is identical and painless. They come with similar bundles that include LaserFax Lite 3.5 and printer and Twain drivers. The 385 includes TextBridge Pro 98 (OCR software); the 480CX comes with the full version of Pagis Pro 2.0.

Installing the PC fax function was a nightmare. Not only is LaserFax Lite one of the weakest PC-based fax programs we've seen, but the installation routine repeatedly failed on both units. Because there was a modem already installed on our test-bed, the Xerox fax driver mapped the parallel port to a different COM port. To find out how to set up the fax driver properly, we had to go to the System Information applet in the Windows Control Panel. Next, we had to adjust the driver manually. For a product

that targets home users, this degree of complication is ridiculous.

Both units passed but did not excel on our concurrency tests. Although we could print and send or receive faxes simultaneously, we couldn't scan, use the copier, or use the PC fax while the unit was printing.

Each system comes with a 300- by 300-dpi color scanner that produced clean, crisp scans. The Twain driver uses a well-organized, tabbed interface to deliver a good range of image acquisition and quality-control options.

The Xerox WorkCentre385's print quality was exactly what you'd expect from a 600- by 600-dpi printer: dead average. It's hard to get excited about either graphics or text from a 600-dpi engine, but the bottom line is that the unit is fine for standard office use, copies, faxes, and the like.

The 385 also turned in average speed performance. Although it managed faster timings on short documents, it fell behind on our long-document tests.

The Xerox WorkCentre 480CX suffered a similar but upside-down fate on our speed tests. Though it lagged behind average on the shorter documents, it turned in just-better-than-average scores on the longer print jobs.

The 480CX fared better on our quality tests. Text was very crisp, with little bleeding and no noticeable staircasing. We were pleased with the crisp, readable appearance of 4-point text at resolutions of 300 by 300 dpi and higher. Graphics quality was a bit mixed. Normal (300-dpi) mode on plain paper generated less than desirable results. Pump up the jets to 1,200-dpi and use either coated or bright white stock and the results improve dramatically. While the WorkCentre models don't compare with the better Epson and HP ink jets, they still deliver acceptable glossy photographic output with decent fine detail, good saturation, and particularly nice contrast.

In short, the Xerox WorkCentre 385 is pricey and underwhelming in performance and quality. You'd do better with the Brother MFC-8600 for a monochrome multifunction unit.

We have a better opinion of the 480CX. A moderate price combined with average speed, high quality, and decent fax and copier functionality makes it a worthy choice.—DAH^{PC}



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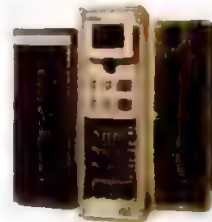
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Left to right: Compaq AlphaServer, Compaq ProLiant, Compaq NonStop Himalaya

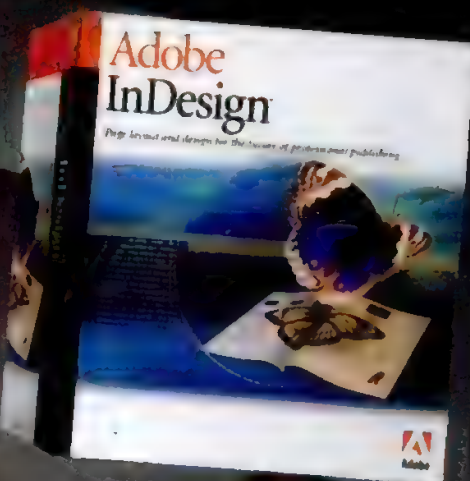


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Emulsion Direct Imaging Technology™
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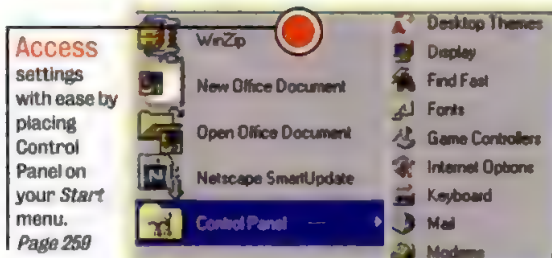
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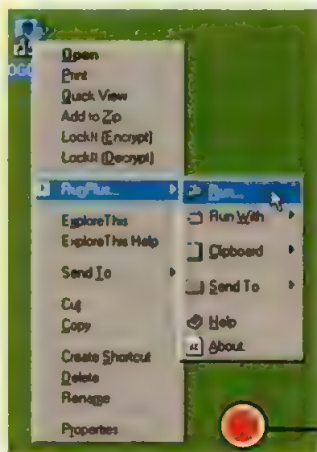


Solutions

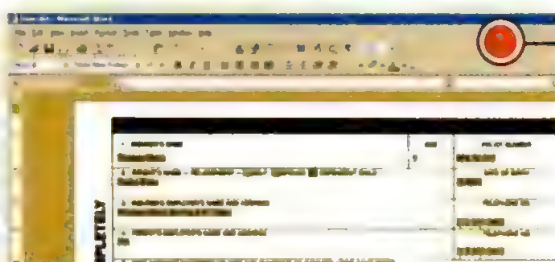


Access settings with ease by placing Control Panel on your Start menu.
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Store your digital data in diminutive flash RAM media.
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Launch programs with command line parameters more easily using RunPlus.
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Scan forms into your PC and fill them in using Word's form fields feature.
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HARDWARE 242

New formats, such as Sony's Memory Stick, make transferring digital information a snap.

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Domain names will finally be distributed logically.

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Microsoft Word's form fields facilitate entries in scanned forms.

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Add virtual folders like your History list to the Start menu.

UTILITIES 263

RunPlus provides a range of options to enhance program launches.

You'll find all of the articles, examples, and code files in this section at Solutions online.
www.pcmag.com



1. Sony's Memory Stick is about the size of a stick of chewing gum and can hold 20 times as much data as a 3.5-inch floppy disk. It features an erasure-prevention switch and a serial connection.



2. CompactFlash is one-third the size of a PC Card and fits into Type II PC Card adapters for transferring data to laptops. The format includes a plug-and-play IDE controller.

3. DataFlash is a full-size Type II PC Card with up to 180MB of storage capacity. It offers the easiest connection with notebooks, but is significantly larger than other flash memory formats.

4. SmartMedia is the thinnest flash memory format. It has no controller on-board, which keeps its manufacturing costs down. The units are also available in a variety of colors.

Solid-State Storage: Memory on the Go

New small formats offer a convenient, portable way to move data between digital devices. *By Alfred Poor*

Where does the light go when you turn off the lamp? Philosophical considerations aside, the answer is that it doesn't matter where it goes; it's gone. And the same is true for most memory; when the power goes off, its contents are lost forever. Although there has always been a need for nonvolatile memory—memory that retains its contents without power—the demands are increasing as people look for easier ways to store and transfer information between computers, hand-held PDAs, digital cameras, and multimedia devices. New memory technologies make this storage smaller, lighter, faster, and more affordable than ever before.

The new storage devices using CompactFlash, DataFlash, SmartMedia, and Sony's new Memory Stick technologies are all descended from the same fundamental idea: ROM. RAM stands for *random access memory*, but ROM stands for *read-only memory*, which refers to one of its features: You can't alter the data stored in it. The other important feature that distinguishes ROM from RAM is that it doesn't need any power to maintain its data; the switches used to store the data in RAM require some current to maintain their state (off or on), but the fixed switches in ROM are stuck in one state and can't be changed. This is why

ROM is sometimes described as *nonvolatile memory*: Its contents remain intact when the power is turned off.

Originally, ROM data had to be constructed right into a chip, as part of the mask process during fabrication—similar to the way data is a permanent part of a CD-ROM. This was expensive and final; it took a lot of time and money to make even a small change in the data stored on the chip.

A more flexible approach was created with *programmable ROM (PROM)*, which is analogous to a CD-R. These chips required a higher write voltage than RAM; the higher voltage would burn data into the different memory locations on the chip. You couldn't change it once it was written, but it did mean that you could create chips with different contents fairly easily.

Next came the erasable PROM (EPROM) chip, which is analogous to CD-RW disks. You could write to the memory, but if you needed to make changes, you had to erase the whole chip and start over.

The next important step was the creation of an electrically erasable, programmable read-only memory (EEPROM) chip, which worked like EPROM, but had one advantage: It could be erased simply by running a higher-than-normal voltage through the chip. The result was ROM



that could be changed on the fly, and it has been used to hold everything from system BIOS code to printer configuration settings.

FLASH IN THE PAN?

All this brings us to the present, and to flash memory (sometimes referred to as *flash rom* or *flash ram*). Flash memory remains closely related to EEPROM, but one of its key advantages is that it does not require voltages higher than those normally available in computers and digital cameras (typically 3 to 5 volts).

As with all erasable ROMs, flash memory is limited to a finite number of write/erase cycles. Early designs were only good for tens of thousands of cycles, but some newer designs are rated for a million cycles or more.

Flash memory has become a staple for BIOS chips—such as those in computers or modems—because it makes upgrading these devices easy for users. You simply download a file from the manufacturer's Web site and then run a utility that erases the contents of the memory and writes the new data to it. It is possible to erase and write to selected portions of the chip as well, so certain areas can be protected while others are being changed. This helps ensure that a system will still be able to boot up should an update session go awry.

These features make flash memory attractive for portable devices—such as PDAs and digital cameras—where users may want to alter some

data areas but leave others intact. Some of these devices have settled on the standard 3.5-inch floppy disk for removable storage, but this mechanical device is large, requires a fair amount of power (leading to shorter battery life), and has a limited capacity. By contrast, a Sony Memory Stick is faster, uses less power, and can hold up to 32MB of data (more than 20 floppy disks).

Another approach is to place a miniature hard disk in a PC Card (PCMCIA) housing. Although these have large capacities—500MB to 1GB—and a lower cost per megabyte, they require a Type III slot (equivalent to two Type II slots) and about ten times the power when active than flash memory does.

Flash memory has a number of advantages over these mechanical, magnetic storage devices. It can be manufactured in packages that are significantly smaller and that draw much less power. And they are solid-state: There are no moving parts that can be damaged. This construction makes them much better able to stand up to the rough handling that can occur with portable devices.

A flash memory card can easily serve as the removable storage medium for a portable device. The more difficult part is transferring the data into a typical computer. One common solution is to create a PC Card reader that accepts the flash memory card at one end and plugs into a standard PC Card Type II slot at the other. For desktop systems that don't have PC Card slots, there are readers that plug into parallel, SCSI, or USB ports. Some readers even support multiple flash memory card formats.

One disadvantage is that there is no uniform standard for flash memory's implementation in portable devices. If you have two portable devices, they may not use the same type of card. Several different card designs are currently competing to become the standard.

Flash Memory Types

Format	Size (inches)	Capacity
CompactFlash	1.43 x 1.68 x 0.13	4MB to 64MB
DataFlash	2.12 x 3.37 x 0.20 (Type II PC Card)	8MB to 160MB
Memory Stick	0.85 x 1.96 x 0.11	4MB to 32MB
SmartMedia	1.46 x 1.78 x 0.03	2MB to 128MB

Back Up to the Hard Disk

If you don't use all of the space on your desktop or notebook computer's hard disk, a combination of drive utilities can help you quickly back up your drive contents. The trick is to segment your disk into two separate areas with a partitioning utility and then copy the original disk's contents onto the new partition using a disk-image backup utility.

You can partition your hard disk using Microsoft's FDISK utility (included with DOS and Windows versions) or with more powerful programs such as PowerQuest Corp.'s Partition Magic 4.0 (\$70 street, www.powerquest.com). When you're done partitioning, utilities such as PowerQuest's Drive Image 2.0 (\$70 list), or Symantec Corp.'s Norton Ghost 2000 Personal Edition (\$63 list, www.symantec.com) can copy your PC's system files, applications, and data to the new partition. Note that image backup utilities can also copy partition images to network disks and onto removable media.—Bruce Brown

Not up to Speed?

I have a system with a 66-MHz system bus, but the motherboard supports 100 MHz. I have installed 64MB of 100-MHz-rated SDRAM. It seems to run fine, but I'm concerned about whether it is being refreshed often enough. I'm also about to buy another 128MB of memory for this system; should I stick with the 100-MHz type or get 66-MHz?

Jeffrey Andrews
via the Internet

You won't have problems using components in a system that is slower than the memory's rated speed. If the difference is too great, the memory won't be refreshed frequently enough, but this will result in immediate and obvious errors. The fact that your system is running smoothly with the faster memory indicates that it will probably run just fine if you add more of the same.

There's an additional benefit to buying more 100-MHz memory: Your motherboard supports the faster speed, and in the future, you may want to consider a processor upgrade to boost performance. By investing in the faster memory now, you won't need to replace it if you change CPUs, which may save you money and aggravation in the long run.—AP

Arms Are Too Short?

I need to place my keyboard about 50 feet from my computer. I have tried extension cables, but they won't work for distances of more than about 25 feet. I've seen devices designed for longer distances, but they are also for video and the mouse, which I don't need. How can I make this work?

Dan Velez
via the Internet

It is possible to extend beyond 25-foot distances if you use high-quality cable. Network Technologies (www.nti.com) offers specially constructed keyboard-extension cables guaranteed to work for distances of up to 100 feet. This is a much cheaper solution than the extender devices for keyboard, video, and mouse, which can cost hundreds of dollars. Some companies to contact for such devices include ATEN (www.aten-usa.com), Cybex (www.cybex.com), Minicom Advanced Systems (www.minicomusa.com), Raritan (www.raritan.com), and Rose Electronics (www.rose.com).—AP

DataFlash. This approach packages the flash memory in a Type II PC Card, making the media easily transportable between any devices that have Type II slots. And to facilitate their use with desktop computers, the cards appear to the system as a standard IDE disk drives. Compared with the small size of many digital cameras and hand-held devices, however, the PC Card form factor is relatively large. As a result, DataFlash cards are generally found in larger, professional-level digital cameras, where size is not a significant factor.

SmartMedia. Also known as Solid State Floppy Disk Card (SSFDC), this small format measures about 1.7 by 1.5 inches—less than half the size of a typical business card—and is wafer-thin, at just 0.03 inches. Different adapters are available for the format, including a PC Card adapter that plugs into any PC Card slot. You can also get a floppy disk adapter for SmartMedia that lets you read the data on a computer with a floppy disk drive but no PC Card slot.

CompactFlash. These cards are about the same size as SmartMedia units but a bit thicker, at 0.13 inches. Part of the reason for this extra size is that the cards include controller circuitry for the memory; they also use the standard IDE

interface. This makes the devices more expensive to manufacture, and at lower capacities CompactFlash costs more than SmartMedia. At 16MB and up, however, the two designs cost about the same. Because CompactFlash cards contain their own controller circuitry, the card readers and adapters cost significantly less to manufacture, and the market prices reflect this difference. A PC Card adapter for SmartMedia typically costs about \$80, but a CompactFlash card adapter costs just \$15.

Memory Stick. This newcomer to the fray comes from Sony. At just 0.85 by 2 inches and 0.11 inches thick, the unit is about the size of a small stick of chewing gum. Sony offers both PC Card and parallel-port adapters for this new format.

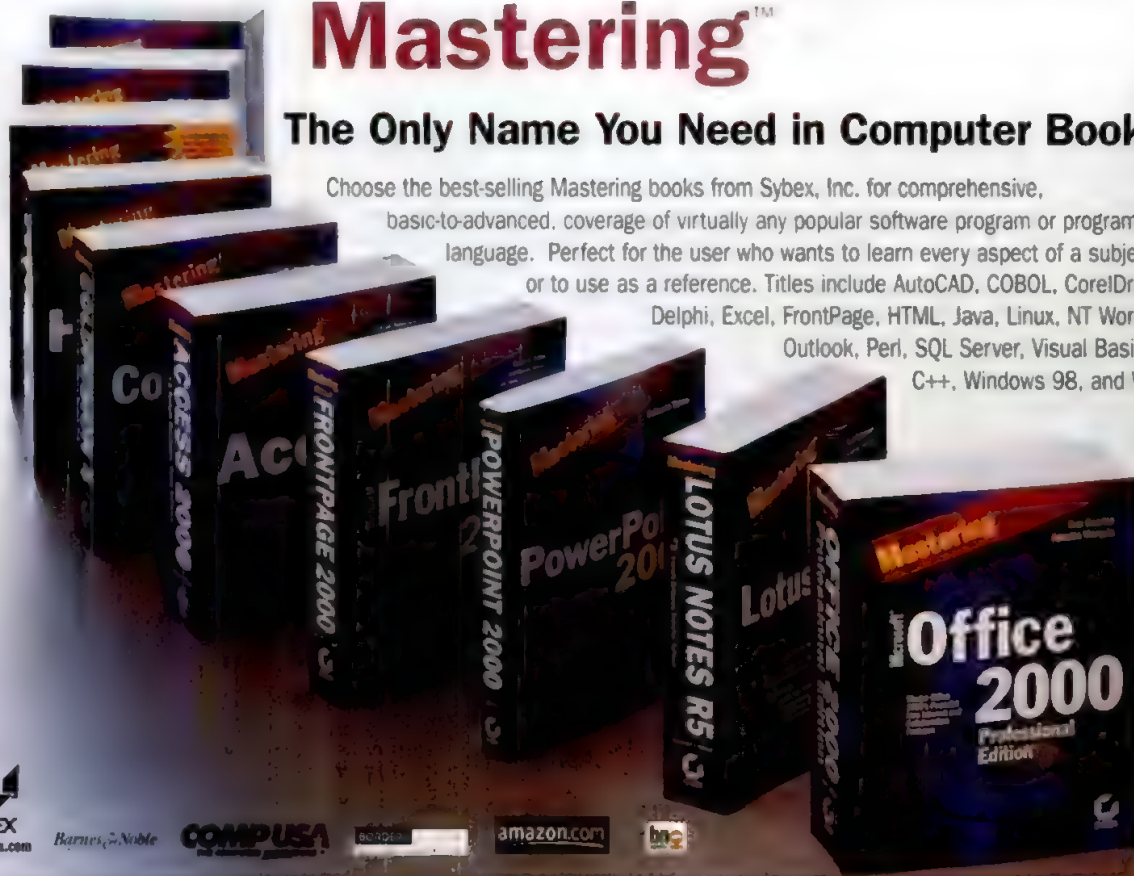
Nonvolatile memory has come a long way from the ROM BIOS chips used in the first IBM PCs. No longer read-only, flash memory can deliver multimegabyte capacity in a remarkably small and tough package. It's become the quick, portable way to transfer large amounts of data among different kinds of devices. **PC**

Alfred Poor is a contributing editor of PC Magazine.

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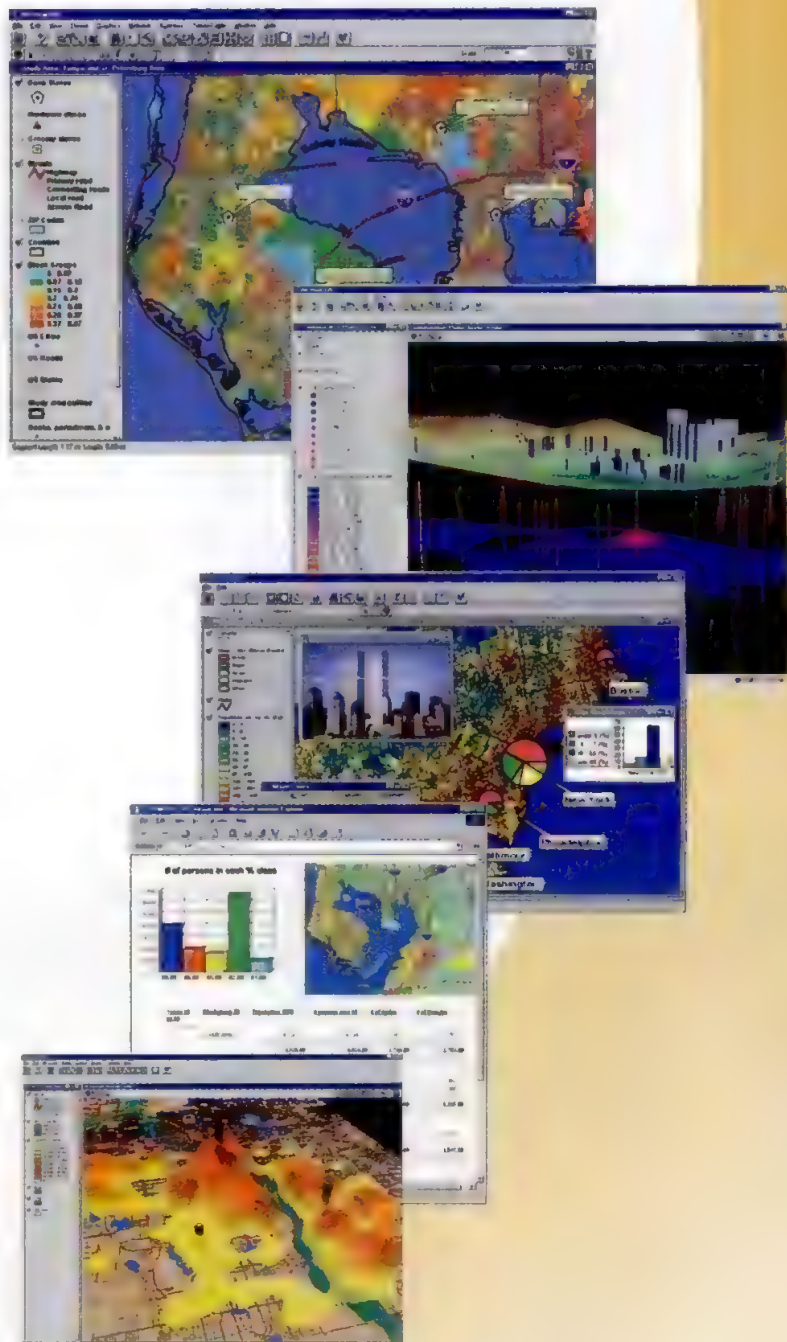
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The Name Game

A new organization should make it easier to establish an Internet identity. *By Neil Randall*

Over the past few years, the Internet has grown from essentially a research vehicle for universities to a multifaceted medium used by people all over the world. With the growth of e-commerce in particular, the names we use to locate the products and services we're interested in have become ever more valuable commodities. Are those names being distributed equitably and efficiently around the world? A new organization has been constituted to help insure that they will be. Let's see what we can expect.

The domain name is at the heart of an Internet identity. You locate companies and organizations on the Web through their domain names, and you get information about e-mail correspondents through their domain names. If you get e-mail from joe@ibm.com, you know that person works for—or is at least associated with—IBM. If the person's address is joe@yale.edu, you can tell you're dealing with someone from Yale University. If the domain name ends with a two-

letter country code, you can be pretty sure that the message is coming from outside the United States: *.ca* means Canada; *.it* means Italy; *.jp* means Japan, and so on. (The United States also has a country code, but the *.us* suffix is very rarely used.)

Nobody doubts the usefulness of these names. At question, however, is the way in which they're distributed. Until recently, the only way to get a domain name of the kind most organizations want has been to register through Network Solutions Inc. (www.nsi.com), holders of a 1993 U.S. government contract to act as distributors of the domains COM, ORG, NET, and EDU. The authority for all domains has been, since the inception of the domain name concept, the Internet Assigned Numbers Authority, better known as IANA (www.iana.org). IANA came into being when the Internet was very different than it is today. For a variety of reasons, this distribution system has come under attack in the past several months. These reasons include the following, most of which are articulated in a 1998 white paper that can be found at www.ntia.doc.gov/ntiahome/domainname/domainhome.htm#1:

- Organizations (businesses in particular) want to see competition in the DNS registration procedures. This would allow flexibility by DNS registrars in pricing and value-added features.
- Organizations registering in the current system have reportedly experienced technical and administrative errors and delays but have no recourse because of the monopoly situation (much like the old AT&T monolith).
- Businesses are increasing their reliance on the Internet, and they want the entire DNS registration and maintenance process to be more formal and less like an ad hoc procedure.
- The current registration system worked well for quite a long time, many suggest, but now the Internet has far outgrown one organization's ability to handle it.
- Fully accountable procedures need to be in place to guarantee the fairness and legality of the distribution of commercially valuable domain names. The days of individuals trying to grab a domain name before a company can claim it should be over.
- Currently, there is too little representation from organizations outside the U.S. on DNS registration and management.



Jon Postel

IANA was founded by Internet pioneer Jon Postel (1943–1998). Dr. Postel, a computer scientist at the University of California's

Information Sciences Institute, started the process of keeping track of Internet names and numbers back in the ARPANET days (initially on a scrap of notebook paper!), and he served as director of IANA since its inception. Over the years, Postel also edited a great many of the Requests for Comments (RFCs), the informal proposals that contributed perhaps more than anything else to the technical building of the Internet. He helped to develop many Internet protocols, including the Domain Name System, File Transfer Protocol, telnet, and the basic Internet Protocol (IP) itself.

Dr. Postel wrote the initial proposal for transferring IANA's responsibilities to a new nonprofit company, which would then privatize domain name registration. He passed away shortly afterward. Those of us who own domain names have them because of Postel's efforts, and many feel it would be thoroughly appropriate if we started changing the term *domain name* to *Postel address* in his memory.

Two E-Mail Accounts in Outlook Express

I have set up a second e-mail account, through my second ISP, in Outlook Express. For some reason, when I send messages, some of them don't go through. I get a message saying something about not relaying. What's going on?

Steve Silbert
via the Internet

The problem most likely lies with your outgoing mail server for the second e-mail account. Although you've probably set the server (in **Tools | Accounts | Properties**) exactly as your ISP instructed, it doesn't work anyway. The reason for this is that you're probably logging on to the Internet through one ISP and attempting to send mail through the account that belongs to the other.

Outgoing (SMTP) mail servers can be set by the ISP to refuse to relay mail. This means that if a user sends a message through the server, but is logged on to a different ISP, the server won't let the message through. Only messages sent from machines logged on to the ISP that owns the server will be allowed through. ISPs do this to prevent nonsubscribers from using their servers.

There are two ways around this problem. The first is to dial in to each ISP before sending messages from that ISP's account. The other—which is much more convenient—is to specify in the **Properties** dialog for the second e-mail account to use the first account's outgoing server. Since you're already logged in to the first ISP, the mail server is not relaying at all.—NR

Control AutoComplete in Internet Explorer 5

How do you clear the IE5 AutoComplete list that appears when you're filling out Web forms and such?

Austin Gean
Novi, Michigan

When you fill out a form under IE5, the browser checks to see whether you've filled out the same kind of field before. If you have, IE5 presents a list of your earlier entries. You can click on one to select it, or arrow down to the one you want and press Enter. But IE5 remem-

bers mistakes as well as correct entries. When you see an error in the AutoComplete list, highlight it and press Del to delete it.

To turn the AutoComplete feature off or on, launch the Internet Options applet from Control Panel. Click the Content tab, and in the *Personal Information* panel click the *AutoComplete* button. Uncheck the *Forms* box to end automatic completion of fields in forms. You may want to uncheck the two boxes that relate to passwords, too. Most users, however, will want to enable automatic completion of Web addresses. You can also clear existing form or password data in this dialog without disabling the AutoComplete feature. —Neil J. Rubenking

Restore Download Action Confirmation

I accidentally unchecked the *Always ask before opening this type of file* box when downloading a ZIP file, and now Windows always opens every ZIP file instead of saving it to disk. Is there any way I can get back the dialog that gives me a choice to either open or save?

Austin Gean
Novi, Michigan

The setting that controls this dialog box is stored with Windows' description of the file type. Launch Windows Explorer and choose *Options* (or *Folder Options*) from the *View* menu. Click the *File types* tab, and select the file type from the list. Click the *Edit* button. In the resulting *Edit File Type* dialog box, find the checkbox labeled *Confirm open after download*. Put a check in this box, click *OK*, and then click *OK* again to close the *Options* dialog. —NJR

Resuming Interrupted Downloads

I download many files from the Internet. Sometimes I start downloading only to find out the file is huge and I don't have time to finish downloading it. This is very frustrating, because next time I have to start again from the beginning. What I'd like is a way to be able to finish downloading at a later time. Are there any free or inexpensive programs that can help me?

Eli Twok
via the Internet

• The U.S. government, which funds the DNS registration system, wants to get out of Internet funding and turn it over to private interests. But the government still wants to maintain the cooperative and consensual nature of Internet management to date.

• There is a danger of antitrust suits resulting from the current noncompetitive system.

The issue is primarily about *top-level domains* (TLDs) and their associated *second-level domains* (SLDs). There are two major types of TLD, *generic* (gTLDs) and *country code* (ccTLDs). The first group covers types of organizations, while ccTLDs cover addresses with a specific national domicile. gTLD suffixes include *.com*, *.org*, and *.gov*, and ccTLD suffixes abbreviate the country: *.fr* is France, *.mx* is Mexico, *.de* is Germany (Deutschland), and so on. SLDs are the names that bear these suffixes: Microsoft.com is an example, as are harvard.edu and iana.org. Proposals exist for the addition of new gTLDs themselves, but for most organizations the domain name question is about acquiring and getting service for the SLD, not the TLD. If you're a new

as, in essence, the successor to IANA. An abbreviation of Internet Corporation for Assigned Names and Numbers, ICANN is a nonprofit, public-benefit organization incorporated in California. ICANN's function is to oversee the present and future distribution and management of domain names and Internet Protocol (IP) numbers on the Internet, and to do so through a board of governors whose constitution must reflect the highly international status of the Internet. You can find all related documentation about ICANN specifically and DNS in general at the NTIA Web site (www.ntia.doc.gov/ntiahome/domainname/domainhome.htm).

One of ICANN's primary areas of responsibility lies in accrediting domain name registrars who will be able to register domain names with the COM, NET, and ORG suffixes. Companies who wish to provide registration services can apply through the ICANN Web site (www.icann.org). The purpose of this group is to develop Internet registration as a competitive subindustry that can exist and flourish without U.S. government funding. As new gTLDs enter

Top-Level Domains and Pre-1999 Distribution

Suffix	Eligibility	Distributor
COM	Commercial organization (existing or potential)	Network Solutions Inc. (www.nsi.com)
ORG	Noncommercial organization (typically)	Network Solutions Inc.
NET	Network services organization	Network Solutions Inc.
EDU	Educational institution	Network Solutions Inc.
GOV	United States government organization	U.S. General Services Administration (www.gsa.gov)
MIL	United States military organization	U.S. Department of Defense Network Information Center (www.mil.nic)
INT	International treaty organizations	International Telecommunications Union (www.itu.int)
Country code	Organization located within the specified country (U.K. addresses are handled somewhat differently)	Various, see www.iana.org/ccld.html for contact information

company, you want a COM suffix (the TLD), but more importantly you want the SLD in place (*mycompany.com*).

The table "Top-Level Domains and Pre-1999 Distribution" illustrates how the top-level domains, and by implication the second-level domains, have been distributed until this year. Given that the gTLDs in the first four rows represent far and away the most numerous generic TLDs on the Internet, Network Solutions' power over the shaping of Internet identity becomes apparent. Furthermore, given the U.S. government's plan to privatize Internet services of this sort, it makes sense that other companies would want a slice of the domain name pie.

MEET THE NEW BOSS

In November of 1998, the National Telecommunication and Information Administration (NTIA) branch of the U.S. Department of Commerce recognized an organization called ICANN

the fray, the new domain name registrars will add those to the lists of TLDs they can distribute.

ICANN itself does not provide registration services, but it is responsible for establishing registrars who can distribute domain names in what is now called the Shared Registration System (SRS). It is also responsible for ensuring that the domain name system operates technically the way it should. For instance, it will ensure that the root servers—the bank of servers from which all domain name data flows onto the Internet—is fully operational, a job still handled by NSI (as of this writing). Furthermore, ICANN is responsible for overseeing the process of deciding upon and adding new gTLDs, and for allocating blocks of IP numbers. As constituted, ICANN is not authoritative but is the organization responsible for working with many groups and individuals from around the world with the goal of arriving at consensus when changes to the domain name system are recommended.



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Many download utilities can restart an interrupted download, as long as the server supports that feature. Most are shareware, so you can try before you buy, and many, like Albino Frog Software's FileHound (<http://hotfiles.zdnet.com/cgi-bin/text/swlib/hotfiles/info.html?rcode=000FXH&b=>), and GetRight, from HeadLight Software (<http://hotfiles.zdnet.com/cgi-bin/text/swlib/hotfiles/info.html?rcode=000DCY&b=>), cost less than \$20.

Before trying to break up a big download, you must check whether the particular server supports resuming a partial download. Start downloading the file, then after a few kilobytes disconnect from the Internet. Reconnect and start the download again. If the utility resumes from where it stopped, the server provides the necessary support. Download as much as you can afford, then cut the connection. Repeat until you have the whole file.—*NJR*

Disturbing Disconnects

I can't seem to stay connected for more than 10 to 15 minutes while using an online gaming service. No matter what I do, I always end up getting disconnected. I've even tried switching to a different ISP, but the problem remains. Any ideas about what's wrong?

Chris Johnson
via the Internet

It's conceivable that you've got a problem with a noisy phone line, but what's more likely is that you have Call Waiting enabled on the phone line. You can test this theory easily by having someone call your phone number while you're online.

Some modems are sensitive to the tone signaling a waiting call, and will disconnect. Others will simply ignore the tone and keep on working. You should be able to configure your modem's dial-up string to disable the service for individual phone calls (usually by dialing *70 before the number). If that doesn't work, you might want to try a different modem to see if it will ignore the signal, or you could have the phone company stop the Call Waiting service.—*Alfred Poor*

Earlier this year, as the Commerce Department required, ICANN established a registration testbed in which five companies would be able to access the SRS and register domains. As testing continued, ICANN named over 60 additional registrars whose duties were to begin when testing was complete (see the table "ICANN Accredited Registrars"). Interestingly, as of this writing Network Solutions wasn't one of the registrars because it hadn't applied, choosing instead to remain a nonaccredited registrar. In fact, NSI has been the center of a controversy regarding the database of domain names and owners it had compiled over its five-year contract as primary registrar. The changes to the registration system include sharing this database among the newly accredited registrars, and NSI objected to this on the basis of contracts with existing domain name owners. The test-bed period was still in progress, and in fact had recently been extended, as of this writing, but these new registrars should be available by the time you read this. You can find out who they are by visiting the ICANN site.

WHY WE CARE

The principle behind establishing competition in industry is to ensure that customers gain. So what will we gain from the new domain name registration system? First, while NSI's service has been reasonably good overall, the new registrars will have to deliver even better service or they won't be around for very long. Many registrars will offer a free transfer of your domain name from your

current registrar, so in effect you can fight bad service by threatening to go elsewhere. The cost of a domain name will be up for grabs as well, although NSI's \$35 per year was hardly exorbitant.

More important, registrars can offer value-added options in name-registration packages. These options might include Web hosting, free software, e-commerce capabilities, and many other services. Registrars could also specialize in specific types of registration, offering packages, for example, most beneficial to small businesses or nonprofit organizations. Because of the new arrangements, organizations will also be able to present cases to obtain domain names that are already taken, as long as the claims are valid according to ICANN and its support organizations.

Do we lose anything?

It's certainly arguable that one central registrar can mean less confusion, but the situation has always been somewhat confusing anyway. More troubling, perhaps, is the potential loss of a little more of the cooperative spirit of the old Internet, where the early builders worked behind the scenes keeping things operational. But as commercial interest in the

Registrars will be able to offer value-added options that might include Web hosting, free software, and e-commerce capabilities.

Internet continues to grow, changes like this are probably inevitable. The only real questions at this point are whether ICANN functions according to its mandate, and whether the accredited registrars uphold their end of the bargain. **PC**

Neil Randall is a contributing editor of PC Magazine and author of *The Soul of the Internet*.

ICANN-Accredited Registrars

Name	URL	Country
THE FIVE ORIGINAL TEST-BED PARTICIPANTS		
America Online	www.aol.com	United States
CORE Council of Internet Registrars	www.corenic.org	Switzerland
France Telecom	www.oleane.com	France
Melbourne IT	www.ina.com.au	Australia
register.com	www.register.com	United States
THE FIRST EIGHT POST-TEST-BED ACCREDITED REGISTRARS		
Abacus America Inc./A+Net	www.abac.com	United States
Advanced Systems Consulting Inc.	www.advsys.com	United States
CASDNS Inc.	www.casdns.net	United States
Domain Bank Inc.	www.domainbank.net	United States
Global Knowledge Group	www.gkg.net	United States
The NameIT Corp.	www.nameit.net	United States
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- 64MB Synchronized DRAM
- VGA with DVMT share memory
- Stereo Audio
- Expansion Slots: 3 PCI, 1 ISA
- 6.4 GB EIDE Hard Disk Drive
- 6X DVD Drive
- 1.44MB Floppy Drive
- 56Kbps V.90 PCI FAX/Modem

Software Included

- Microsoft® Windows® 98 Second Edition
- Corel Wordperfect Office 2000

C'est Bon 400**\$549.00****System Specification**

- Intel® Celeron™ Processor 400 MHz with 128K Cache
- 64MB Synchronized DRAM
- VGA with DVMT share memory
- Stereo Audio
- Expansion Slots: 3 PCI, 1 ISA
- 6.4 GB EIDE Hard Disk Drive
- 48X CD-ROM Drive
- 1.44MB Floppy Drive
- 56Kbps V.90 PCI FAX/Modem

Software Included

- Microsoft® Windows® 98 Second Edition
- Corel Wordperfect Suite 8

C'est Bon 366**\$449.00****System Specification**

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- VGA with DVMT share memory
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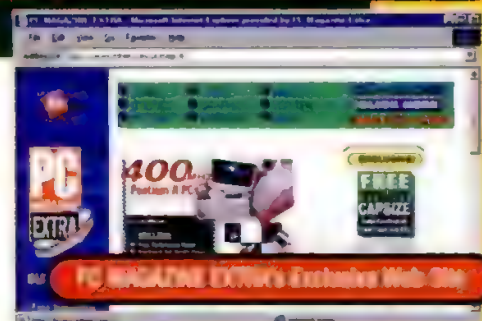
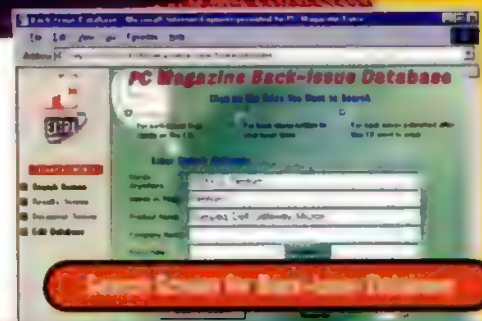
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Scanned Forms in Word

Use form fields with your scanned documents in Microsoft Word 97 and 2000. By M. David Stone

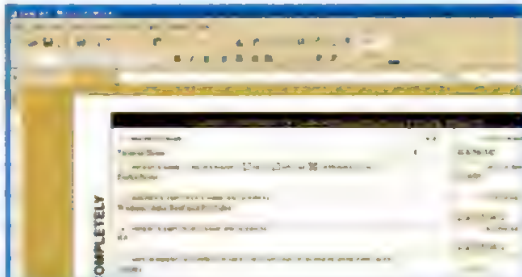
Many offices use printed forms, such as requisitions, invoices, reports, and so on. Why not use your word processor to fill them in? Microsoft Word's form fields enable you to set up and reuse the word processor for filling in forms after you've scanned them. We'll show you how to take advantage of this feature in both Word 97 and 2000.

We'll assume that the form is a standard letter size and that you know how to scan a form and save it in a format that Word can read. We'll also assume that you know how to use Word's *File | Page Setup* command to set the proper margins and page orientation, how to test the output on the printer and resize the image if necessary, how to use the Word 97 *Insert | Picture | From File* command to insert the scanned image with the image set to *Float over text*, and how to position the image on the page.

One of our User to User tips ("Filling in Scanned Forms," June 8, 1999) can get

Behind Text for the wrapping style, then *OK*. If you try typing text at this point, it will be hidden behind the picture. (In fact, Word changes the wrapping setting to *In front of text*.) The workaround is to choose *Format | Picture*, then set the wrapping to *Behind Text* a second time. Word will then remember the setting, and you can enter text in the text layer over the form.

The rest of this tip applies to both Word 97 and Word 2000. To take advantage of form fields, you should insert the fields into a table. Without a table, accidentally hitting *Enter* in a



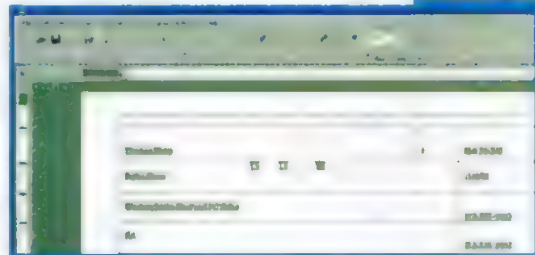
A couple of tricks let you superimpose the form entries over the scanned image.

field will push other fields down the page and out of alignment with the form.

Before inserting the table, choose *Tools | Options*, then *View*. Make sure the check boxes for *Object Anchors* (under *Show* in Word 97, or under *Print and Web Layout Options* in Word 2000) and for

Paragraph Marks (under *Nonprinting Characters* in Word 97, or under *Formatting Marks* in Word 2000) are checked. Choose *OK* to return to the document, then click on the inserted picture next to the first paragraph mark on the page. If it's elsewhere, click on the anchor and drag it there. This is important, because the table has to be inserted in a paragraph after the form. If you insert it in the same paragraph that the form is anchored to or in an earlier paragraph, the table will push the form down the page.

Next, move the cursor to the second paragraph and click on the *Tables and Borders* button in the *Standard* toolbar to open the *Tables and Borders* toolbar. Make sure the *Draw Table* button is selected, then use the mouse to draw a table that defines cells where you want to place fields. Start by defining the outside border of the entire table; then fill in the cells. (If you've never



This Word table shows entries for a scanned form, without the form in place.

you up to speed with these issues if you need help. You can find the tip at <http://cgi.zdnet.com/slink?6994>. The only difference in procedure when adding form fields is that before you insert the picture, you should hit *Enter* once and return the cursor to the first line before choosing *Insert | Picture*. In order to type in a text layer over the inserted picture, you need to first set *Format | Picture | Wrapping* to *Through*, choose *OK*, and then reset it to *None*.

In Word 2000, the details for inserting the form and setting the wrapping are a little different. Here again, you should hit *Enter* once before you insert the picture, then return the cursor to the first line of the document. Next, choose *Insert | Picture | From File*. Then choose *Insert*.

Click on the inserted picture to select it, choose *Format | Picture*, then *Layout*, and select

Adding a Calculate Feature To Word

Microsoft Word 97 lets you calculate totals in several ways, but none are as easy as the way Word 2 provided. In Word 2, you could type a simple formula, like $54.23 + (10/5)$, select the text, choose *Tools | Calculate*, and insert the result using *Edit | Paste*. Is there any way to add this feature to Word 97 through a macro?

Rowland Hill
Concord, Massachusetts

Although it's true that you won't find this command anywhere on the Word 7, 97, or 2000 menus, you will find it in the list of commands available through *Tools | Customize*. More important, you can add it to a menu, keystroke, or toolbar button, so you can use it the same way as in Word 2.

To add the command to a Word 7 menu, for example, choose *Tools | Customize*, then *Menus*. In the *Categories* list box, highlight *All Commands*, then scroll through the *Commands* list to find and highlight the *ToolsCalculate* command. Choose the menu in which you want to place the command by using the *Change What Menu* box, choose a position in the *Position on Menu* box, specify a menu item name in the *Name on Menu* box, and choose the *Add* button to finish adding the command.

To add the command to a Word 97 or Word 2000 menu, choose *Tools | Customize*, then *Commands*. In the *Categories* list box choose *All Commands*, then scroll through the list to find the *ToolsCalculate* command. Drag the command up to the *Tools* menu. When Word opens the menu, drag the command to any position you want. Drop it in place by releasing the mouse button, then choose *Close* to close the *Customize* dialog box. Now you can easily calculate selected expressions. —MDS

Open Excel Without a New Document

Is there a way to turn off the automatic opening of Book1 as a new spreadsheet every time I start Excel 97?

Mark Price
via the Internet

To open Excel without opening a new, blank document, use the */e* startup switch. For example, if you want to

start Excel from a shortcut on your desktop, you can add the /e to the properties for the shortcut. Right-click on the shortcut, choose *Properties*, then *Shortcut*, and look in the *Target* text box, which should include the full Excel path and filename, ending with *Excel.exe*. Add a space after *Excel.exe*, then add the switch, so it reads *...excel.exe /e*. Then choose *OK* to close the dialog box and save the changes. The next time you use the shortcut to start Excel, it will open without a blank document.

This switch will work for Excel 7, Excel 97, and Excel 2000. When you installed Excel 2000, it may have installed a shortcut that won't let you edit the properties. If you run across such a shortcut, simply create a new one by navigating to the Excel directory, finding *excel.exe*, then right-clicking on it and choosing *Create Shortcut*. You may want to keep two Excel shortcuts handy, one of which will open Excel without a new blank document and one of which will open it with a new blank document. —MDS

used this feature, you should be able to learn it with just a little experimentation.) The top of the table should start lower on the page than the top of the scanned image.

After you finish creating the table, close the *Tables and Borders* toolbar, select the entire table and choose *Format | Borders and Shading*, then *Borders*, and set borders to *None* (this will keep the table borders from printing). Then choose *Table*, and make sure Word is set to show gridlines. If *Show Gridlines* appears on the *Table* menu, click it; if you see *Hide Gridlines*, leave it as is. Next, move the cursor to the first row in the table, choose *Table | Select Row* (*Table | Select | Row* in Word 2000), then *Table | Cell Height and Width* (*Table | Table Properties | Row* in Word 2000), and set the *Height of row* to *Exactly* its current size. Work your way through the rows with the *Next Row* button, setting each one to *Exactly* its current size.

You can now insert the form fields. Open the *Forms* toolbar by choosing *View | Toolbars | Forms*. To insert a form field in any given cell, move to the cell you want the field in, use spaces, tabs, or returns to position the cursor in the field, and click on the *Text Form Field*, *Check Box Form Field*, or *Drop-Down Form Field* button in the *Forms* toolbar, as appropriate. (Hold the cur-

sor over a button if you're not sure which button is which—a tooltip will identify it.)

Word will insert the field at the cursor position, using default settings. You can change the settings by double-clicking on the field. With the text form field, for example, you can change the type from regular text to number, date, current date, current time, or calculation, and you can define a length for the field or make the length unlimited. Similarly, you can define a size for the box in the check box field, and set the default as checked or unchecked. With the drop-down field, you can add a list of items to choose from, so you won't have to type an entry several times. And for any of these fields, you can tell Word to run a macro when you enter or exit the field.

With all the fields inserted, choose *Tools | Protect Document*, choose *Forms*, then *OK*. Save the file using *Document Template* as the type, give it an appropriate name, and put it in one of your template directories.

And that's it. To fill in the form, choose *File | New*, select the form template as the template to use, and fill in the form fields using the Tab key to move from field to field. **PC**

M. David Stone is a contributing editor of PC Magazine.

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It's the kind of thing good neighbors and good corporate citizens must do. We hope it helps and we hope you'll come out and take part when the Journey of Hope tour visits a city near you.

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August 31	Denver
September 17	Seattle
September 25	Napa/San Francisco
October 3	Albuquerque
November 15	Las Vegas

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Working with Virtual Folders

Add virtual folders to your Start menu for an easy productivity boost. *By Neil J. Rubenking*

Windows Explorer displays the contents of your computer system in the form of a giant tree, with Desktop at the root. The branches of this tree represent folders, but not all of the folders correspond to actual directories on disk. Some of them, like Control Panel and Recycle Bin, are *virtual folders*, representing system objects rather than physical directories. When you click a file system folder, Explorer reads that folder's contents from the directory on disk. When you click a virtual folder, however, Explorer queries a system object for information about the virtual folder's contents.

In general, manipulating system objects is best left to hotshot programmers, but there's one technique that anyone can use. If you know how to create a new folder, you can put a handy link to any virtual folder right on your Start menu. Each system object is identified in the Windows Registry by a Globally Unique Identifier, or GUID for short. GUIDs are 128-bit numbers, normally represented as a daunting collection of hexadecimal digits enclosed in curly brackets. If you know the GUID for a virtual folder, you can create a file-system link and, for example, put that virtual folder on the Start menu.

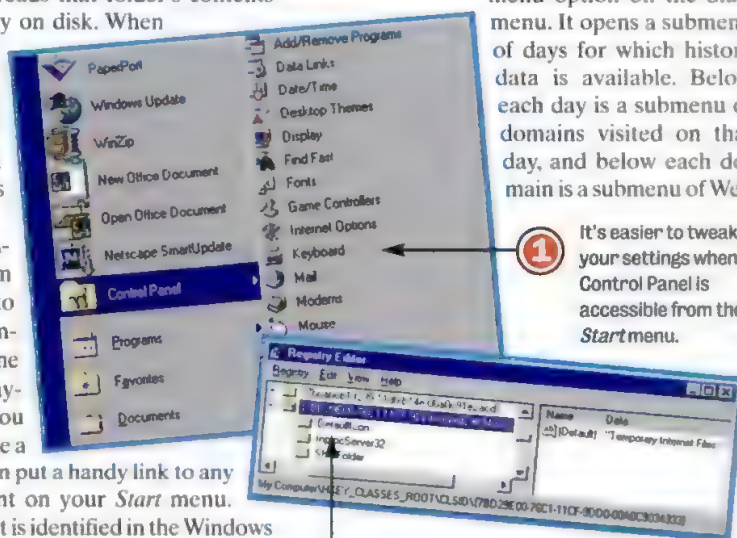
By default, to launch a Control Panel applet, you must click the Start button, click Settings, and open Control Panel. Windows Explorer queries the Control Panel system object to get a list of applets for display. Finally, you double-click the desired applet. All that clicking can get tedious if you need to tweak Control Panel settings often. Try this instead:

- Right-click the Start button.
- Choose *Explore*.
- Right-click in a vacant area of Explorer's right-hand pane.
- Choose *New | Folder* from the pop-up menu.
- Name the folder Control Panel. {21EC2020-3AEA-1069-A2DD-08002B30309D}.

Now click the Start button, and you'll see a

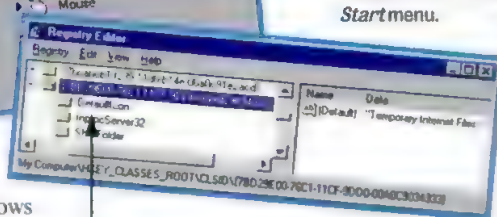
new menu item called *Control Panel*. When clicked, it opens a submenu of Control Panel applets you can launch with a single click (see Figure 1).

In the same way, you can put your Internet Explorer history list on the Start menu. Just follow the instructions above, but use History. {FF393560-C2A7-11CF-bff4-444553540000} for the folder name. Now choose the new *History* menu option on the Start menu. It opens a submenu of days for which history data is available. Below each day is a submenu of domains visited on that day, and below each domain is a submenu of Web



1 It's easier to tweak your settings when Control Panel is accessible from the Start menu.

2 You can locate GUIDs for some virtual folders by searching the Registry.



pages, listed by name. Click on one of those pages to open it in your browser.

GETTING THE NUMBERS

The precise set of registered system objects will differ on different computers, but most systems will have quite a few virtual folders that can be linked to the file system. You can explore the possibilities using the TweakUI utility, part of Microsoft's free (and support-free) Power Toys collection. Launch TweakUI from Control Panel and click the Desktop tab. Each of the items listed on this tab is a potential virtual folder link. Select one, click the *Create as file* button, and save the file in your Start menu folder. (If you're not sure which folder that is, right-click the Start button and choose *Explore*.) Not all of the items listed in TweakUI make good additions to the Start menu. Some will yield an empty menu, while others may generate a menu

Quick Access to Drives

A great way to access drives quickly is to create a whole-drive toolbar. Just double-click *My Computer* and drag a drive icon onto the taskbar. Make sure to drop it on the taskbar itself, not on an existing toolbar. Then shrink the toolbar by dragging the grab-handle as far to the right as it will go. Now a single-click on the double arrow will show you every folder on your drive. Note that you can also drag special folders like *Control Panel* from *My Computer* to the taskbar, and, if you want, you can grab the upper edge of the taskbar with the mouse and resize it to allow more than one row of toolbars. —NJR

Manipulating Multiple Taskbar Buttons

Here's an easy way to deal with multiple programs on your taskbar: Hold down the Ctrl key and click on only the buttons of the programs you're interested in. Then right-click on one of the buttons and you'll see the usual *Cascade*, *Tile*, *Restore*, *Minimize*, *Maximize*, and *Close* commands. The command you choose will be applied only to the programs you've selected!

Simon Naomi
via the Internet

First, minimize all the programs by right-clicking the taskbar and choosing *Minimize All Windows*. To close several of the programs, hold down the Ctrl key and click each program's taskbar button. Because you're holding down Ctrl, the clicked-on programs aren't activated. Now right-click one of them and choose *Close* from the pop-up menu.

If you'd rather, say, tile just two of the programs, click their buttons while holding Ctrl. Right-click one and choose *Tile Horizontally* or *Tile Vertically*. This tip requires the Windows Desktop Update, which is part of Windows 98 and can be installed on Windows 95 or Windows NT 4.0 systems along with Microsoft Internet Explorer 4. —NJR

A Better Open With Dialog

When I double-click on an unknown file type, I choose a program from the *Open With* dialog, but I always have to remove the check from the *Always use this program to open this file box*. Then I found a better way.

Use Regedit to open HKEY_CLASSES_ROOT\Unknown\shell\openas\command. In the right-hand pane, double-click the default value and append a space to the end of the data string. This actually disables the check box. Even if you do check it, the unknown file type will not be registered.

Dennis Giesbrecht
Vancouver, BC, Canada

The *Open With* dialog lets you choose to open an unknown file with any program you please. If the *Always use...* check box is checked when you click *OK*, Windows creates a permanent association between the file's extension and the application. If you don't like such new file associations, just apply the Registry modification described above. To restore the default behavior, open the same Registry key and remove the space. —NJR

Preventing Automatic ScanDisk

I have my computer collecting data while I am not at home, even when I am on vacation. I have a UPS, but occasionally, with a line surge or a prolonged power outage, the computer is shut off in mid-operation and restarts. Under these conditions, Windows runs ScanDisk, which requires operator intervention to respond to its questions. I lose all sorts of data until I get home and answer its silly questions. How can I keep ScanDisk from running automatically?

Greg Ostrom
via the Internet

By default, Windows 95 OSR2 and Windows 98 run ScanDisk when started after abnormal shutdown. You can turn off this behavior using the *Boot* tab in TweakUI, which you can download from www.microsoft.com/Windows95/downloads/contents/WUToys/W95PwrToysSet. Or, you can do it manually at an MS-DOS prompt. Enter `ATTRIB -R -S -H C:\MSDOS.SYS`, then `NOTEPAD C:\MSDOS.SYS`. In Notepad, find the line `AutoScan=1` and change it to `AutoScan=0`. If no `AutoScan` line is present, insert `AutoScan=0` just after the [Options] heading. Save the file, then enter the command `ATTRIB +R +S +H C:\MSDOS.SYS`. If you turn off automatic scanning, be sure you run ScanDisk regularly when you're present at the computer. —NJR

whose items don't do anything useful. If you find you've created a useless virtual folder link, delete it using Explorer.

SEARCH THE REGISTRY

You can also hunt for possible virtual folders in the Registry. Don't worry; you won't actually be making any changes in the Registry. Select *Run* from the *Start* menu, enter *Regedit*, and click *OK*. Now double-click *hkey_classes_root* and scroll down to the key named *CLSID*. Double-click this key and you'll find it contains hundreds of GUIDs. Fortunately, only a handful of them define virtual folders.

Press `Ctrl+F`, and in the *Find* dialog enter *ShellFolder*. Check the *Key* box and the *Match whole string only* box, but leave the other two boxes blank. Now click *Find Next*. You should quickly find a key named *ShellFolder*.

Highlight its parent key in the tree, then look in the right-hand pane to see the default value. This is the name of the system object defined by this GUID. Create a folder in the *Start* menu as described above, and give it a name built from the default value and the key name. For example, if you found a *ShellFolder* subkey under a key named {7BD29E00-76C1-11CF-9DD0-00A0C9034933} with the default value *Temporary Internet Files*, you would create a folder named *Temporary Internet Files*. {7BD29E00-76C1-11CF-9DD0-00A0C9034933} as shown in Figure 2. When you're done, press `F3` to find the next matching item. Keep going until you reach a key that you've already seen.

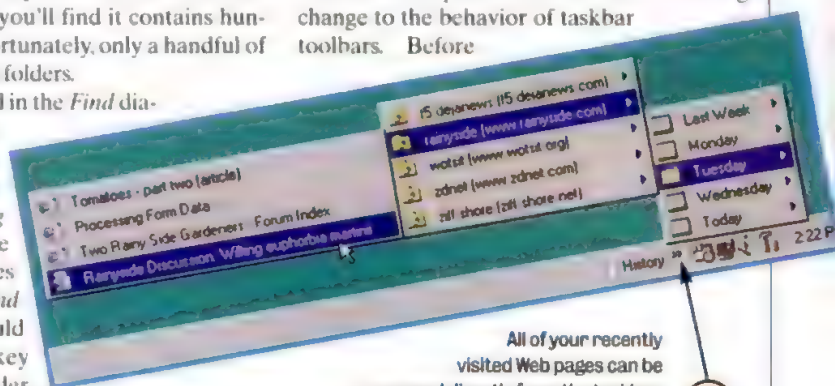
Now click on *hkey_classes_root\clsid* again and start another search. This time, search for *ExtShellFolderViews*. For each found key, verify that its parent is named *shell*. Then build a folder name from the default value and key name of the *shell* key's parent. Depending on your system configuration, this search may not produce any results. Try all of the new *Start* menu items corresponding to these virtual folders, and delete any that aren't useful.

VIRTUAL FOLDER TOOLBARS

Taskbar toolbars were introduced with the Windows Desktop Update. The WDU is part of Windows 98, and can be installed optionally along with Internet Explorer 4. (Note: the WDU is not installed with Internet Explorer 5.) If your system

has the WDU installed, you can put a virtual folder on the taskbar. Right-click the *Start* button, choose *Explore*, and locate one of the virtual folder links you created earlier. Drag it to the taskbar, and it will immediately appear as a toolbar. In most cases, you'll want to right-click the new toolbar and uncheck the *Show Title* and *Show Text* menu items. Using this technique, you can have one-click access to any Control Panel applet.

Internet Explorer 5 made an interesting change to the behavior of taskbar toolbars. Before



All of your recently visited Web pages can be accessed directly from the taskbar, if you know how to use virtual folders.

3

IE5, a toolbar with too many items would sprout arrow buttons at both ends, allowing you to scroll horizontally through the items. Under IE5, the items that don't fit are pushed off into a submenu, very much like the *Start* menu. Try this: Create a virtual folder link for Internet History, as explained above, and drag it to the taskbar. Leave the *Show Title* and *Show Text* menu items checked. Now grab the handle at the left and shrink this toolbar as much as possible. All you'll see is the title and a small button marked with two arrows (>>). Clicking this button will bring up a menu very much like the *Start* menu, but dedicated to Internet History (Figure 3).

Neil J. Rubenking is a contributing editor of PC Magazine.

PREP WORK

- Microsoft's TweakUI utility can help you find virtual folders. If TweakUI is not present in Control Panel, start by downloading the Power Toys from www.microsoft.com/Windows95/downloads/contents/WUToys/W95PwrToysSet. After running the self-extracting program, right-click *TweakUI.INF* and choose *Install*. You can also find *TweakUI.INF* on the Windows 98 CD-ROM, in the folder `/tools/reskit/powertoy`. For some reason, this file was removed in Win 98 Second Edition.

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Run Faster, Run Better

A set of mini-utilities makes running, moving, and copying files easier. *By Mark Sweeney*



This issue's free utility, **RunPlus**, is a collection of power tools for launching applications. You access it by right-clicking on a filename in a Microsoft Windows Explorer window. The RunPlus **Run** option makes running programs that require command line options easier. The **Run With** feature lets you select from a list of programs when opening a file. You can also use RunPlus to add programs

quickly and easily to the Windows **Send To** menu. Finally, the utility includes a group of options for copying icons or fully qualified filenames to the clipboard.

RunPlus runs under Windows 95, Windows 98, and Windows NT 4.0. An article about how to use RunPlus and how it was written is available on our Web site at www.pcmag.com/utilities. A link for downloading the utility and its source code can also be found there.

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Support: To obtain help for PC Magazine's free utilities, visit our online discussion area on the Internet (www.pcmag.com/utilities/support.html).

Mark Sweeney, the author of RunPlus, is vice president of software at Clearview Software International, a company that specializes in client/server applications for Windows. Sheryl Carter is the editor of the Utilities column and a contributing editor of PC Magazine.

1. When you choose **Run** from the RunPlus menu, Windows' **Run** dialog is displayed with the selected filename inserted. You can then add command line parameters or options in the dialog.

2. The **Run With** menu contains the application associated with the file type in the registry and the last few programs you selected using the RunPlus **Browse** feature. You can set the number of items that RunPlus displays.

3. The **Clipboard** menu lets you copy a fully qualified filename—long filename version or short filename version—onto the Windows clipboard. You can also copy either the large or the small icon associated with a file.

4. The **Send To** menu, which is available from the context menus of most objects, offers another way to open files with a specific application. You can add to or access the **Send To** folder from within RunPlus.

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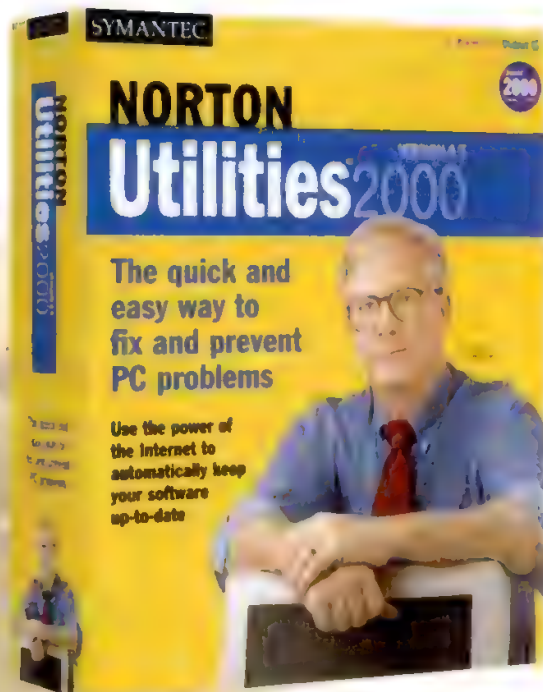
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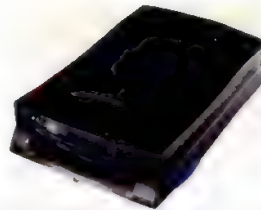
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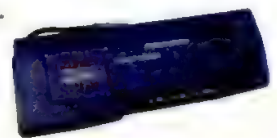
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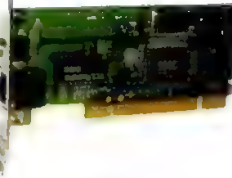
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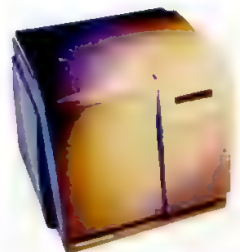
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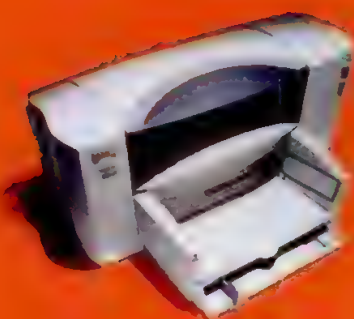
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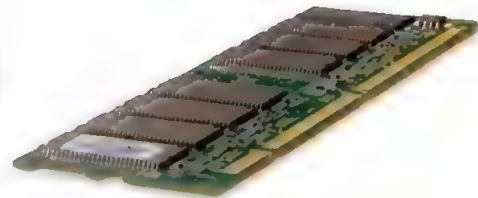
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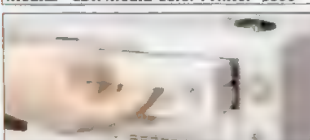
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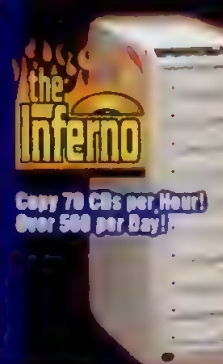
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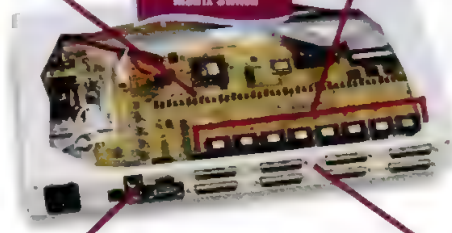
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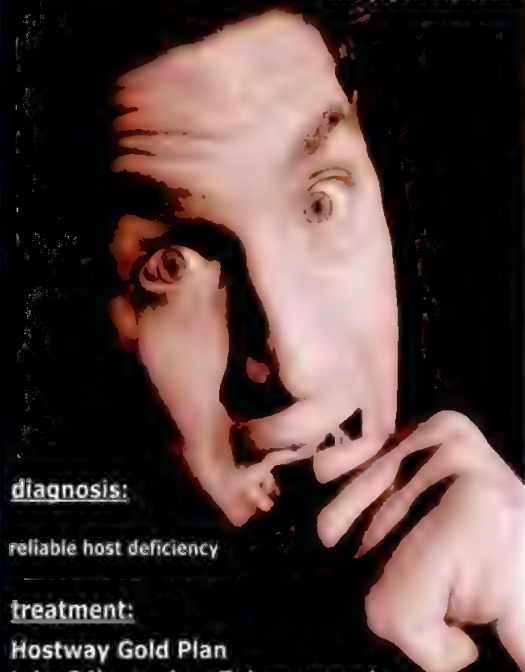
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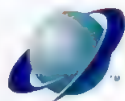


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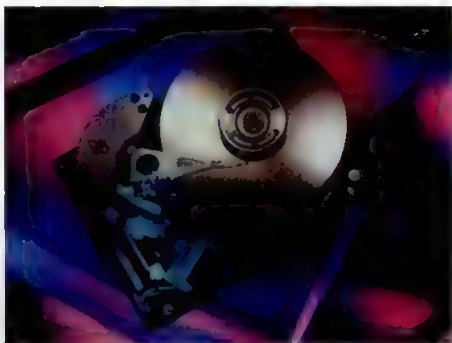
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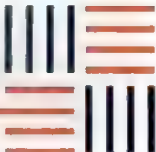
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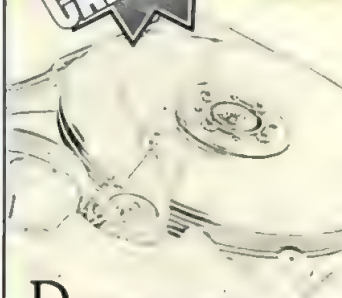
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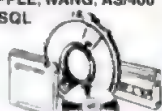
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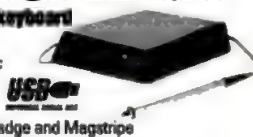
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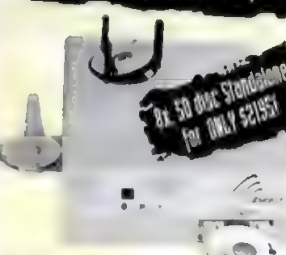
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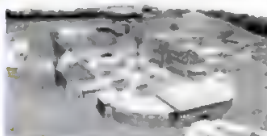
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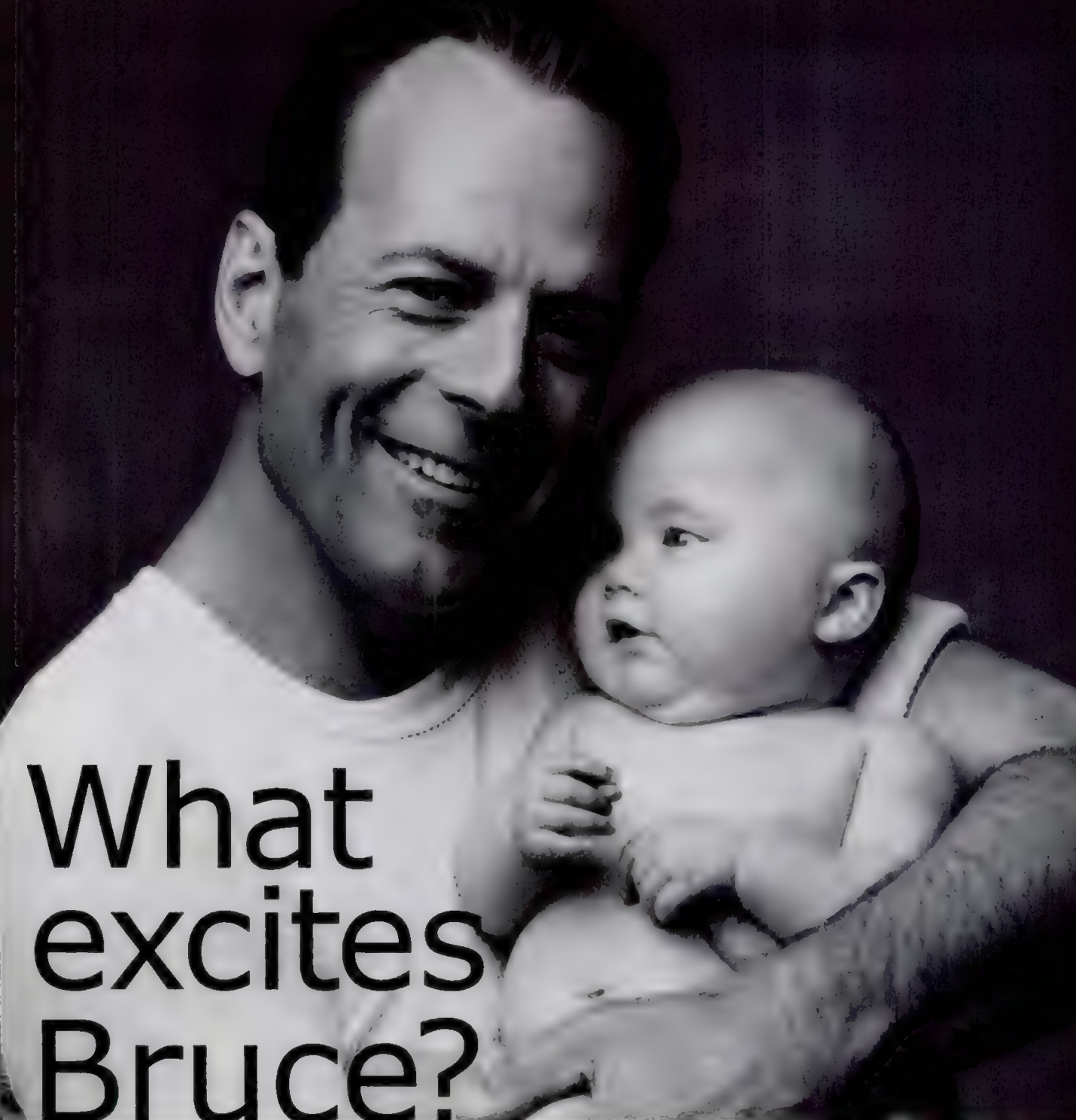
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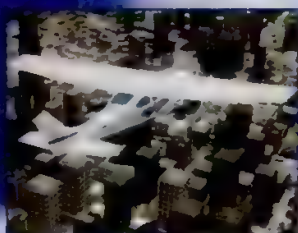
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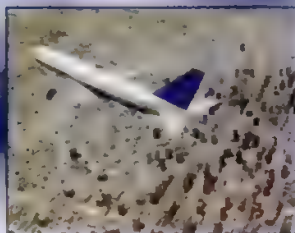
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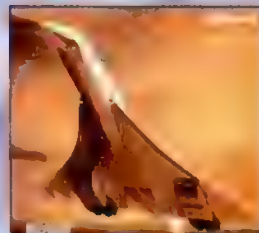
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AFTER HOURS

THE HOME SIDE OF COMPUTING



FLIGHT SIMULATORS

Fly like an Eagle

By Alfred Poor

Pop quiz: What's the best-selling computer game of all time? The answer may surprise you: Microsoft Flight Simulator. Total sales since Microsoft took over the title 17 years ago exceed 10 million copies. That's not bad for a game with no scoring and no end, where your main objective is "Don't crash."

There are many reasons for Flight Simulator's success—and Flight Simulator 98 is no exception. First and foremost is our fascination with flight: Even before the Wright brothers

soared off sand dunes nearly 100 years ago, the concept of flying had captured people's imaginations. Another reason for the product's success is its realism. Flight Simulator has consistently stretched the limits of how well a PC can model the real world.

Flight Simulator, once the only serious general aviation flying title for the PC (simulating a range from noncombat biplanes to jumbo jets), no longer has unchallenged supremacy of the simulated skies. A variety of quality titles have been released in recent years, two of which we review here.

Though the first edition of *Pro Pilot*, from Dynamix (part of Sierra), had numerous rough spots, *Pro Pilot 99* shows tremendous improvement with a terrific navigation system. And a newcomer, *Terminal Reality's Fly!*, is a formidable competitor right out of the blocks. It is by far the best-looking flight simulator currently on the market.

FLY!

Terminal Reality's *Fly!* has impressive origins: A number of its designers came from the Bruce Artwick Organization, developer of the original Flight Simulator.

All that experience shines through in this inaugural release. It is especially apparent in *Fly!*'s most striking feature, light and

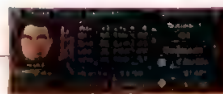
wispy clouds that you can see through as you fly into their edges—just as in the real world.

Fly! comes with only five aircraft, but they cover the whole range of general aviation: a Cessna Skyhawk 172R, a Piper Malibu Mirage, a Piper Navajo Chieftain (twin-engine), a Beechcraft King Air 200 (turbo-prop twin), and a Raytheon Hawker 800XP (twin business jet). Though starting the Cessna's fuel-injected engine is a bit tricky, you can ask the program to demonstrate the procedure.

Fly! includes a graphical weight-and-balance calculator, used for a very realistic check. Most general-aviation aircraft aren't capable of both taking a full load of fuel and filling all the cabin seats. To ensure safe weight and adequate balance, click on a seat in the layout diagram and enter the weight of the person sitting there. The program automatically updates the weight calculations.

For navigation, *Fly!* has a GPS window, a vector map that shows a schematic view of the surrounding area, and scanned sectional charts. These sectionals are the real deal, based on the same charts that pilots actually use to fly. For added realism, download and import current weather observation data from the Web.

Though bitmapped satellite imagery makes for some beautiful scenery, objects such as towers are distracting at a distance; scintillation (sparkle or glimmer)



QUICK CLIPS

Revolt, race, construct; join the Federation, and watch the Confederacy crumble. Here's our brief look at five new releases. *Page 298.*

AFTER HOURS



for many airports in major cities, it shows taxiways, ramps, terminals, hangars, and even city buildings, for recognizable skylines.

FS98 bundles eight different aircraft, from the venerable Cessna Skylane to the Boeing 737 airliner to a helicopter, the Bell Jet-Ranger. There is even an aerobatic Extra 300S, just like the one

world-famous aerobatic flier Patty Wagstaff performs her daredevil moves in. Helpful multimedia lessons on maneuvers include in-the-cockpit video clips of Patty giving you personal demonstrations.

The aircraft fly realistically and have detailed control panels. Support for 3-D-accelerated graphics adapters at different resolutions makes the window view smooth and realistic. A feature called Adventures (flights guided by interactive scripts) lets you receive instructions from air traffic control in a manner remarkably true to life.

Perhaps the most compelling attraction of FS98 is Microsoft's continued support of the program as an open system. For years, the company has distributed a Software Development Kit (SDK) free, making it possible for third parties to create a rich variety of companion products that add new aircraft, panels, scenery, and adventures to the basic package.

FS98 is not without shortcomings. The printed documentation is skimpy at best, consist-

ing largely of small black-and-white charts that show few details and are difficult to use.

Also, the scenery and weather images, which were so exciting when the program first appeared, are starting to show their age. The clouds are probably the worst among the current products, and there are few areas with bitmapped terrain. And airports are unnaturally easy to spot from the air.

The program remains a dependable and worthwhile choice, especially in view of its myriad third-party options—a feature the better-looking Fly!

when it comes to mimicking the real-life mechanics of flying an airplane.

Right away, you'll notice that the aircraft and terrain look smoother than FS98's and that the scenery has more detail. The excellent GPS navigation feature is also more useful and easier to use than FS98's limited map feature. It can even show you the direction and distance to your next way point.

The program comes with six aircraft: two versions of the Cessna 172 Skyhawk, a Beech Bonanza, Beechcraft Baron and Super King Air twins, and a

makes them stand out too much. Runways are a bit harder to spot here than with Microsoft Flight Simulator 98, but the scintillation effects still make them jump out at you long before you'd notice them in the real world.

Initially, we encountered a number of system crashes when switching from the full-screen, 3-D view to the windowed view. Fortunately, a patch on Terminal Reality's Web site was able to fix the problem.

Other drawbacks include a user interface that is occasionally awkward and, from time to time, hesitation when the program is drawing scenery (even on a 450-MHz Pentium III system). According to a company representative, installing the scenery files to the hard disk—instead of accessing them from the CD-ROM drive—can alleviate this problem.

In spite of these flaws, Fly!'s realistic scenery—the best in this roundup—and close attention to the details of flying help make its rookie flight a success.

Microsoft Flight Simulator 98

Microsoft Flight Simulator remains the standard against which all newcomers must be compared. Microsoft Flight Simulator 98 (FS98), which was released in November of 1997, includes more than 3,000 airports from the United States and around the world. The program depicts mostly just runways with no scenery details, but



can't claim. Microsoft isn't standing still, either. Microsoft Flight Simulator 2000—planned for release toward the end of the year—is set to add to FS98's already impressive array of features, providing navigation data from the Jeppesen database. (Jeppesen being the Rand McNally of aviation), new exterior and interior aircraft modeling, and improved weather effects.

Cessna CitationJet business jet. (When you start up the Cessna Skyhawk for the first time, you'll be struck by how realistic the engine sounds as it sputters to life.)

Three printed manuals cover everything from running the program to detailed flight instruction information. Pro Pilot '99 also includes a weight calculator for each aircraft, but the program does not determine whether the weight distribution keeps the center of gravity within the manufacturer's limits.

Pro Pilot '99's realism falls short in other ways as well. The

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aircraft do not handle accurately on the ground, and the Cessna Skyhawk takes off as if it had a

with OpenGL acceleration. Nevertheless, they give off a lot of distracting scintillation as

rocket attached. According to a company representative, a free patch will be available for download from Dynamix's Web site to make the aircraft handle in a more realistic manner.

The clouds are attractive, at a distance, when you use a graphics card

you fly along, especially when you're under an overcast sky. And up close, you can see that the clouds are made up of large cubes. Note that the program supports hardware acceleration only on Glide-compatible graphics adapters.

An interesting flight-planning feature lets you receive instructions from air traffic control as you fly from airport to airport. At times this goes awry. In one case, the tower operator sent the plane away from the destination airport and never turned it back!

Pro Pilot '99's most serious problem involves what's missing. It does not include roads as

separate features, and the satellite imagery does not show them clearly. Other objects, such as bridges, are also missing. For instance, the giant Verazano-Narrows Bridge at the mouth of New York Harbor is just a colored stripe on the water's surface. The lack of these features makes it difficult to navigate by ground references—a significant flaw.

Pro Pilot '99's positive aspects, such as its excellent manuals and terrific scenery, should make the program appealing to those who are newcomers to the genre. Experienced virtual pilots will quickly grow tired of its flaws.

Combat Flight Sims

If it's airborne action you're looking for, consider one of these flight combat simulations. Typically, this kind of game is a bit less intimidating to the casual game player than civil-aviation sims are, though you can still run into some seriously sophisticated and realistic flight simulation with certain titles (such as Falcon 4.0).

The big difference between these and the civil-aviation simulators is that you get to fly a fighter plane or attack helicopter and wage virtual war in the simulated skies. Loads of titles are available; here are some we consider top-notch.

Solid 3-D graphics, dynamic campaigns, and both American and Russian helicopters make **Apache Havoc** a must-have for anyone who's ever wanted to fly an attack chopper. (\$45 street; Empire Interactive, 800-216-9706, www.empire-us.com.)

European Air War's excellent dynamic campaigns and remarkably lifelike terrain are impressive, but the massive and memorable aerial engagements are what really sets this game apart from all others. (\$20 street; Microprose/Hasbro Interactive, 800-400-1352, www.microprose.com.)

Sequel to Falcon 3.0, the classic F-16 jet combat simulation, **Falcon 4.0** is the perfect game for die-hard jet combat enthusiasts. The game offers stunning 3-D graphics, highly realistic game play, and remarkable attention to detail. (\$20 street; Microprose/Hasbro Interactive, 800-400-1352, www.microprose.com.)

The definitive flight simulation depicting modern jet combat, **F-15** puts you in the pilot's seat of the U.S. Air Force's F-15 air superiority fighter. Great graphics and customizable game play highlight this excellent title. (\$20 street; Jane's Combat Simulations, 800-245-4525, www.janes.com.)

Beautiful 3-D graphics and support for exciting multiplayer modes highlight NovaLogic's action-packed depiction of flight

combat in America's next-generation jet fighter: **F-22 Lightning 3** even lets you launch virtual thermonuclear weapons—assuming that sort of thing interests you. (\$34.95 list; NovaLogic Inc., 800-858-1322, www.novalogic.com.)



Combining the original AH-64D Longbow with its stunning sequel Longbow 2, this two-in-one gives you the absolute best of PC helicopter combat. **Longbow Anthology** can be tough to find these days, but it is available

and is well worth the search. (\$40 street; Jane's Combat Simulations, 800-245-4525, www.janes.com.)

Microsoft has finally come through with an air combat variation of its flight simulation game. **Microsoft Combat Flight Simulator's** adjustable skill levels, impressive 3-D graphics, and extensive game-play options could make this game just as popular as its civil-aviation predecessor. (\$35 street; Microsoft Corp., 800-426-9400, www.microsoft.com.)

Flight combat sims tend to be less intimidating to the casual game player.

One of the best World War I flight simulations ever created, **Red Baron 3D** is actually a revised—and greatly improved—version of Red Baron II. With a top-notch 3Dfx-enhanced mode, a dynamic campaign, and more than 20 aircraft, this game is among the best flight combat games around. (\$39.95 list; Dynamix/Sierra, 800-757-7707, www.sierra.com.)

As its name implies, **WWII Fighters** is all about World War II air combat, and it offers stunning 3-D graphics and customizable realism settings. (\$39.95 list; Jane's Combat Simulations, 800-245-4525, www.janes.com.)—Michael E. Ryan



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AFTER HOURS

Add-On Products For Microsoft Flight Simulator

As we mentioned earlier, one of the greatest strengths of Microsoft Flight Simulator is that it is an open system letting many individuals and companies support it by creating add-on products. Here are just a few of the commercially available add-ons.

AIRCRAFT

In spite of the range of planes bundled with Flight Simulator, people are interested in flying other aircraft with it as well, from historical favorites such as the Piper Cub to the latest in military models.

No matter where your tastes lie, you'll find plenty to choose from in **The Legendary Aircraft Suite**, from Flight 1 Software. You get 100 types of airplanes, and many of the *airliners* (planes operated by airlines) come in the *liveries* or color schemes of different companies, so you get 200 models in all. The flight models for each plane have been carefully developed to handle naturally.

The planes are divided into categories: historical designs (such as the *Wright Flyer* and the *Spirit of St. Louis*), World War II military aircraft, general aviation planes, classic airliners, modern military planes, and jet airliners. When you highlight a plane in a category list, the program displays detailed aircraft information.

Want to create your own airline? The easiest path to success is **Fly the Best!**, from Abacus Software. You get a collection of 18 detailed commercial airliners, with a custom instrument panel for each type of aircraft. Planes include the venerable DC-9 and the Boeing 747.

The fun begins when you run **Instant Aircraft Maker** to select a plane's paint scheme and designate it for

freight or passenger use. Though you can't input your own graphics, the program gives you a wide range of choices, including a soccer ball and zebra stripes. The documentation is a bit thin.

If you aspire to fly the big jets, then **Jumbo Jet 2.0**, from Data Becker, is for you. It includes 66 different 747s, with varying model numbers and liveries. Each airplane is based on a real-world aircraft, and the pro-



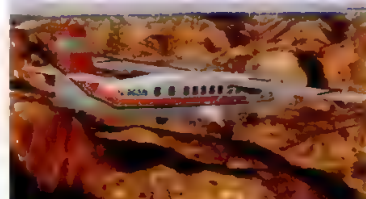
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gram includes the history of each one.

Jumbo Jet also has charts and approach plates on disk for different areas, but you can only print these out; you can't view them on the screen. As a bonus, you get add-on scenery for the Virginia, Maryland, and Delaware region (including Washington) and for Geneva, Switzerland. The manual's detailed information about flying the 747 includes performance tables and charts.

SCENERY

Plenty of add-ons provide more details than the basic Flight Simulator scenery. **Grand Canyon**, from Wilco Publishing, provides stunning vistas of this natural wonder. It includes a color chart for the

region, three new aircraft, and a helicopter. There are three interactive adventures, two of which are repeated for the helicopter.

Another stunning scenery collection is **MegaScenery Pacific Northwest**, from PC Aviator. As the name says, this add-on covers the northwestern corner of the United States, with finely detailed satellite imagery. It has color charts and charts for instrument panel-based flight. The manual is filled mostly with instrument flight references, including a discussion of approach plates, but the little bit of information is printed in black ink on a dark gray background, which makes it difficult to read.

The scenery is very dense, and you'll need plenty of processing power to run this collection smoothly. We saw 20 frames per second—more than adequate for normal flight—on a 450-MHz Pentium III system.

If you think that departure and arrival are more important than what you see en route, consider **Airport 2000**, from Wilco Publishing. This collection of seven detailed airports from around the world includes Los Angeles International, Tokyo Narita, and Paris's Charles de Gaulle airport.

To make things more interesting, the program also gives you 11 commercial aircraft in different liveries, plus nine interactive adventures, which take you on some short and long routes.

MORE ADVENTURE

Air Races, by WizardWorks, tracks your times to make the flights more exciting. You also get five classic racers—including the stubby and unstable Gee Bee Model R-1—and three additional aircraft. And you get bonus copies of the DEA Rescue adventures, in which you must rescue drug enforcement agents in jungle and urban settings.

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Quick Clips

Jagged Alliance 2

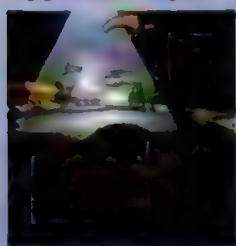
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happy, or upset, or if they simply dislike one another, expect them to speak with individualistic expressions and voices. Attention to detail is impressive. Violence and adult language and themes abound, making Jagged Alliance 2 unsuitable for children. \$49.95 list; TalonSoft Inc., 410-933-9191, www.talonsoft.com.

Jeff Gordon XS Racing

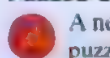
 NASCAR fans may enjoy this futuristic arcade racing game, codesigned by young phenom Jeff Gordon. It won't win any prizes for complexity, but its attractive graphics engine and morph-on-

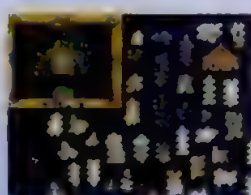


ing video clips and smaller puzzle games inside that explain the structure's historical backgrounds. \$24.95 list; Wrebbit Interactive, 800-973-2248, www.wrebbit.com.

the-go damage repair system make this game stand out. Forty cars and ten tracks make it light and enjoyable. But heavy sponsorship from Pepsico is overbearing to the point of making you wonder why the game isn't free. \$39.95 list; ASC Games, 203-655-0032, www.ascgames.com.

Puzz3D CD

 A new series of interactive puzzles from Wrebbit brings three-dimensional puzzles to your desktop. The three currently available programs let you build a historical structure—Notre Dame Cathedral, a Victorian mansion, or Neuschwanstein, a planned but never completed Bavarian castle. Once the puzzle is



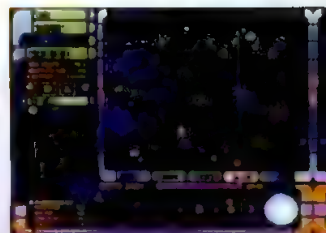
completed, you can explore the inside of each structure, with well-done

video clips and smaller puzzle games inside that explain the structure's historical backgrounds. \$24.95 list; Wrebbit Interactive, 800-973-2248, www.wrebbit.com.

Star Trek: Birth of the Federation

 With a cool design, evocative music, and game elements firmly grounded in the universe of "Star Trek: The Next Generation," this game might very well appeal to

fans. The task is to build up one of five galactic superpowers (Cardassian, Federation, Ferengi, Klingon, or Romulan). Simplistic game design, predictable computer players, and a poor, incomplete game manual stand in your way. \$49.95 list; MicroProse/Hasbro Interactive, 800-400-1352, www.microprose.com.



The Civil War Experience

 A murky interface and a dearth of multimedia features drag down what is otherwise an interesting historical reference tool. Starting from the conditions that led the country to war, and following events up until the assassination of Abraham Lincoln, The Civil War Experience is not lacking in quality content. The lack of hotkeys, however, and the game's limited interactivity make the title a wasted opportunity. \$39.95 list; SouthPeak Interactive, 800-774-6183, www.southpeak.com. **P**



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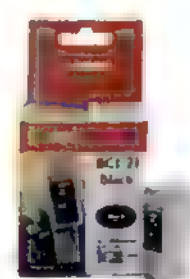
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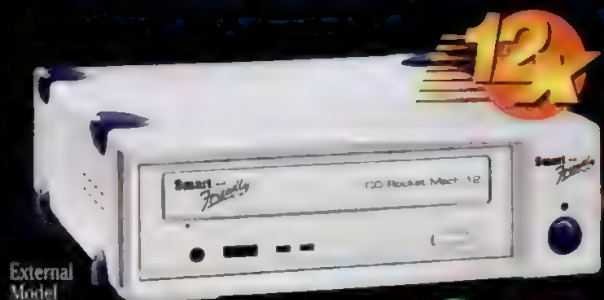
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CTVTM50A	Celeron 400MHz	15"	64MB PC 100	8GB UDMA	32X	AGP/8MB	ATX	Mid-Tower	\$23/Month	\$699.99	\$299.99
CTVTM57A	AMD K6-2/400 3DNow!	15"	128MB PC 100	13GB UDMA	40X	AGP/8MB	ATX	Micro-ATX	\$23/Month	\$779.99	\$379.99
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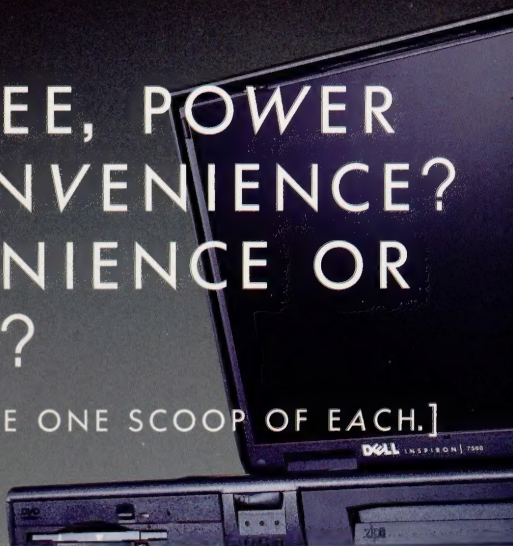


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